NACA

RESEARCH MEMORANDUM

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AT SUBSONIC AND SUPERSONIC SPEEDS - COMPARISON OF THREE
WINGS OF ASPECT RATIO 2 OF RECTANGULAR, SWEPT-BACK,
AND TRIANGULAR PLAN FORM, INCLUDING EFFECTS OF
THICKNESS DISTRIBUTION

By Ronald C. Hightower

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Moffett Field, Calif.

NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS
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SUMMARY

The aerodynamic characteristics of three wing-body combinations
employing wings of aspect ratio 2, of rectangular, swept-back, and
triangular plan form are compared at subsonic and supersonic speeds.
All three wings had 3-percent-thick airfoil sections. The rectangular
and swept-back wings were investigated with both biconvex and rounded-
nose airfoil sections. The latter were obtained by replacing the portion
of the biconvex sections forward of the midchord location with a semi-
ellipse of minor axis equal to the airfoil maximum thickness. The
triangular wing was composed of NACA 0003-63 airfoil sections.

The test Reynolds numbers were 1.8 million and 4.4 million for the
rectangular wing, 1.9 million and 4.8 million for the swept-back wing,
and 3.0 million and 7.5 million for the triangular wing. Most of the
data were obtained in the range of Mach numbers from 0.61 to 0.93 and
from 1.20 to 1.90. Data were not obtained for the complete Mach number
range for the triangular wing and for the other wings at the higher
Reynolds numbers.

The variation from rectangular to swept-back to triangular plan
form influenced the aerodynamic characteristics in the following manner:

1. Reduced the lift-curve slope
2. Reduced the center-of-pressure travel with Mach number
3. Reduced the minimum drag coefficient at supersonic speeds
4. Increased the maximum lift-drag ratio at supersonic speeds

The airfoil-section thickness distribution had a significant effect
on the drag characteristics of the rectangular and swept-back wings.

The minimum drag coefficients of the wings with rounded-nose sections
were lower than those of the wings with biconvex sections at all subsonic
speeds and at supersonic speeds for which the Mach number is less than
that for the attachment of the bow wave to the sharp leading edge of the
biconvex section.

INTRODUCTION

A research program is in progress at the Ames Aeronautical Laboratory
to ascertain experimentally at subsonic and supersonic Mach numbers the
aerodynamic characteristics of wings of interest in the design of high-
speed airplanes. The effects of variations in plan form, twist, camber,
and thickness are being investigated. The results of this program to
date are presented in references 1 to 16. These results showed that
plan form was one of the primary factors influencing the characteristics
of wings in the high-subsonic and supersonic speed ranges. This report
compares three wings of aspect ratio 2 of rectangular, swept-back, and
triangular[1] plan form. The effects of modifying biconvex airfoil sections
to rounded-nose airfoil sections on the characteristics of the rectangular
and swept-back wings are also presented.

NOTATION

b   wing span

$\bar{c}$ mean aerodynamic chord, $\dfrac{\int_0^{b/2} c^2 dy}{\int_0^{b/2} c \, dy}$

c   local wing chord

l length of body including portion removed to accommodate sting

L/D   lift-drag ratio

$(L/D)_{max}$ maximum lift-drag ratio

M   Mach number

q   free-stream dynamic pressure

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[1]Data for the triangular wing were presented in reference 1.

R   Reynolds number based on the mean aerodynamic chord

r   radius of body

r_0 maximum body radius

S   total wing area, including area formed by extending leading and trailing edges to plane of symmetry

x   longitudinal distance from nose of body

y   spanwise distance from the vertical plane of symmetry

α angle of attack of body axis, deg

C_D drag coefficient, drag/qS

$C_{D_{min}}$ minimum drag coefficient

C_L lift coefficient, lift/qS

C_m pitching-moment coefficient referred to quarter point of mean aerodynamic chord, pitching moment/$qS\bar{c}$

$\dfrac{dC_L}{d\alpha}$ slope of the lift curve measured in the range of lift coefficients from -0.1 to +0.1

APPARATUS

Wind Tunnel and Equipment

The experimental investigation was conducted in the Ames 6- by 6-foot supersonic wind tunnel. In this wind tunnel, the Mach number can be varied continuously and the stagnation pressure can be regulated to maintain a given test Reynolds number. The air is dried to prevent formation of condensation shocks. Further information on this wind tunnel is presented in reference 17.

The models were sting mounted in the tunnel, the diameter of the sting being about 93 percent of the diameter of the body base. The pitch plane of the model support was horizontal. The 4-inch-diameter, four-component, strain-gage balance, described in reference 18, was enclosed within the bodies of the models and was used to measure the aerodynamic forces and moments.

Models

Plan and front views of the models and certain model dimensions are given in figure 1. (The dimensions of the triangular-wing model of ref. 1 are also given for convenience.) The biconvex profile and the rounded-nose modification of the rectangular and swept-back wings are illustrated in figure 2. The triangular wing was constructed of solid steel. The basic rectangular and swept-back wings with biconvex sections were also of steel, and were modified by adding bismuth-tin alloy forward of the midchord locations to obtain the rounded-nose sections. The profile of the rounded-nose section forward of the midchord location was elliptical; the tangent to the airfoil section at the midchord location was horizontal. The bodies used in the tests were constructed of steel and aluminum. The surfaces of the bodies and wings were polished smooth. Other geometric characteristics of the models are tabulated as follows:

Wings			
Wing plan form	Rectangular	Swept back	Triangular
Aspect ratio	2	2	2
Taper ratio	1	0.333	0
Sweepback of leading edge, deg	0	45	63.4
Total area, S, sq ft	2.425	2.425	4.014
Mean aerodynamic chord, $\bar{c}$, ft	1.102	1.195	1.889
Dihedral, deg	0	0	0
Camber	None	None	None
Twist, deg	0	0	0
Incidence, deg	0	0	0
Distance, wing-chord plane to body axis, ft	0	0	0
Airfoil section (streamwise)	3% thick, biconvex / 3% thick, rounded nose	3% thick, biconvex / 3% thick, rounded nose	NACA 0003-63

Bodies			
Wing plan form	Rectangular	Swept back	Triangular
Fineness ratio (based upon length l, fig. 1)	12.5	12.5	12.5
Cross-section shape	Circular	Circular	Circular
Maximum cross-sectional area, sq ft	0.123	0.123	0.204
Ratio of maximum cross-sectional area to wing area	0.0509	0.0509	0.0509

TESTS AND PROCEDURE

Range of Test Variables

The lift, drag, and pitching moment of the models were measured at angles of attack from approximately -4° to +17°. The results were obtained at Reynolds numbers of 1.8 million and 4.4 million for the rectangular wing, 1.9 million and 4.8 million for the swept-back wing, and 3.0 million and 7.5 million for the triangular wing. Data for the rectangular and swept-back wings at the lower Reynolds numbers were obtained at Mach numbers from 0.61 to 0.93 and from 1.20 to 1.90. The rest of the data did not cover the complete Mach number range because of either electrical power limitations of the wind tunnel or choking effects of the model on the air stream in the test section.

Reduction of Data

The test data have been reduced to standard NACA coefficient form. Factors which could affect the accuracy of these results, together with the corrections applied, are discussed in the following paragraphs.

Tunnel-wall interference.- Corrections to the subsonic results for the induced effects of the tunnel walls resulting from lift on the models were made according to the methods of reference 19. The numerical values of these corrections (which were added to the uncorrected data) were:

Wing plan form	Rectangular	Swept back	Triangular
$\Delta\alpha$	$0.55\ C_L$	$0.55\ C_L$	$0.93\ C_L$
ΔC_D	$.0095\ C_L^2$	$.0095\ C_L^2$	$.016\ C_L^2$

No corrections were made to the pitching-moment coefficients.

The effects of constriction of the flow at subsonic speeds by the tunnel walls were taken into account by the method of reference 20. This correction was calculated for conditions at zero angle of attack and was applied throughout the angle-of-attack range. At a Mach number of 0.91, the increase in the Mach number over that determined from a calibration of the wind tunnel without a model in place was 4 percent for the triangular wing model and 2 percent for the rectangular and swept-back-wing models.

For the tests at supersonic speeds, the reflection from the tunnel walls of the Mach wave originating at the nose of the body did not cross the model. No corrections were required, therefore, for tunnel-wall effects.

Stream variations.- Tests of the triangular wing of reference 1 in both the normal and inverted positions showed no stream curvature or inclination. Tests of the rectangular and swept-back wings in both the normal and inverted positions have indicated a maximum apparent stream inclination of approximately -0.1°. The measured values of the apparent stream inclination were not consistent and, since unknown factors contributed to this effect, no corrections were made to the data of this report. The effects of stream curvature and stream inclination in the yaw plane of the models are not known, but are judged to be small according to the results of reference 21.

A survey of the air stream at subsonic and supersonic speeds has shown that there is a static-pressure variation in the test section of sufficient magnitude to affect the drag results. Corrections were added to the measured drag coefficients, therefore, to account for the longitudinal buoyancy caused by this static-pressure variation. These corrections varied from -0.0008 to +0.0009.

Support interference.- At subsonic speeds, the effects of support interference on the aerodynamic characteristics of the models are not known. For the present tailless models, it is believed that such effects consisted primarily of a change in the pressure at the base of the model fuselage. In an effort to correct at least partially for this support interference, the base pressure of the model fuselage was measured and

the drag data were adjusted to correspond to a base pressure equal to
the static pressure of the free stream.

At supersonic speeds, the effects of support interference of a
body-sting configuration similar to that of the present models are shown
by reference 22 to be confined to a change in base pressure. The pre-
viously mentioned adjustment of the drag for base pressure, therefore,
was applied at supersonic speeds.

RESULTS AND DISCUSSION

The lift, drag, and pitching-moment coefficients (for various angles
of attack) for the rectangular and swept-back wing models, as well as
for the triangular wing model[2] of reference 1, are presented in tables
I to V. A summary of the aerodynamic characteristics of the models at
the higher Reynolds numbers is presented in figure 3. The effects of
Reynolds number are shown in figures 4, 5, 6, and 7. Pitching-moment
curves for some subsonic Mach numbers at the lower Reynolds numbers were
irregular through zero lift and the center-of-pressure locations for these
Mach numbers are not presented.

Effects of Wing Plan Form

In the following discussion of the effects of wing plan form on
various aerodynamic parameters, wings with similar thickness distributions
are compared. The triangular wing having an NACA 0003-63 section is
compared with the rectangular and swept-back wings having rounded-nose
sections.

Variations in plan form affected the lift-curve slopes at supersonic
speeds more than at subsonic speeds (fig. 3(a)). As the Mach number
increased in the supersonic speed range, the lift-curve slopes approached
a constant value. For these three wings of the same aspect ratio, the
lift-curve slope decreased as the leading-edge sweepback increased. At
subsonic speeds, the lift curves for the rectangular and swept-back wings
were nonlinear for lift coefficients greater than 0.1. The lift-curve
slopes for these wings increased until a lift coefficient of approximately

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[2]The subsonic results of reference 1 have been corrected for Mach number,
    dynamic pressure, and base drag according to the results of a survey
    of the air stream in the Ames 6- by 6-foot supersonic wind tunnel
    performed after the publication of reference 1. A buoyancy correction
    was also computed and added to the subsonic results.

0.7 was reached, then decreased at higher lift coefficients. The lift curves for the triangular wing were linear at all Mach numbers.

The variation from rectangular to swept-back to triangular plan form reduced the variation of the center-of-pressure location (in percent of mean aerodynamic chord) with Mach number (fig. 3(b)). For these three wings, even though the length of the mean aerodynamic chord increased as the sweepback increased, the travel of the center of pressure in actual dimension was least for the wing of greatest sweepback. At subsonic speeds, the pitching-moment curves for the rectangular and swept-back wings were nonlinear for lift coefficients greater than 0.1. The center-of-pressure location for these wings moved rearward as the lift coefficient increased. The pitching-moment curves for the triangular wing were linear for all Mach numbers.

The minimum drag coefficient at supersonic speeds (fig. 3(c)) was reduced by increasing the leading-edge sweepback. No general trends were concluded at subsonic speeds since any variations with changes in plan form were probably less than those caused by differences between the thickness distributions of the NACA 0003-63 section and the rounded-nose section and by differences in the amount of wing area enclosed within the fuselage.

The decrease of minimum drag at supersonic speeds with increasing sweepback angle was reflected in higher maximum lift-drag ratios (fig. 3(d)). The decrease of minimum drag more than offset the effect of the small decrease in lift-curve slope with increasing sweepback angle. At subsonic speeds, the effect of plan form on the maximum lift-drag ratio was opposite to that at supersonic speeds. The decrease of lift which resulted from an increase in the sweepback angle contributed the major effect and caused a decrease in the maximum lift-drag ratio.

Effects of Airfoil-Section Thickness Distribution

Replacing the biconvex sections of the rectangular and swept-back wings with rounded-nose sections caused only slight differences in the lift-curve slopes and center-of-pressure locations (figs. 3(a) and 3(b)).

The minimum drag at subsonic speeds of both the rectangular and swept-back wings was lower with the rounded-nose sections than with the biconvex sections (fig. 3(c)). The lower drag of the rounded-nose section resulted in higher maximum lift-drag ratios (fig. 3(d)). At supersonic speeds, the drag of the wings with rounded leading edges became higher at a Mach number of about 1.2 on the rectangular wing and (using lower Reynolds number data of figs. 6(a) and (b)) at a Mach number of 1.7 on the swept-back wing. It is estimated that these Mach numbers correspond

very nearly to the Mach numbers required for attachment of the bow shock wave on the sharp leading edges. In general, at supersonic speeds, the drag of sharp-leading-edge wings with detached bow waves might be expected to be greater than that of rounded-leading-edge wings.

Effects of Reynolds Number

Small increases in the lift-curve slopes of both the rectangular and swept-back wings were obtained in the subsonic speed range by increasing the Reynolds number (fig. 4). No consistent viscous effects on lift-curve slope were evident at supersonic speeds.

The effect of Reynolds number on the center-of-pressure locations of the models was greater at subsonic speeds than at supersonic speeds (fig. 5). The effects were slight, however, and no consistent variations with Mach number were evident.

The minimum drag coefficients of the models varied consistently with Reynolds number (fig. 6). For all models, an increase in Reynolds number caused an increase in drag. This was attributed to the larger areas of turbulent boundary layer at the higher Reynolds numbers and the accompanying increased skin-friction drag of the turbulent boundary layer.

The lower minimum drag of the wings with sharp leading edges at the lower Reynolds numbers shown in figure 6(a) was reflected in the higher maximum lift-drag ratios shown in figure 7(a). The wings with rounded leading edges also showed lower minimum drag at the lower Reynolds numbers (fig. 6(b)), but an examination of the data showed a higher drag due to lift at the lower Reynolds numbers. This resulted in a slightly lower maximum lift-drag ratio at subsonic speeds for both wings with rounded leading edges at the lower Reynolds numbers (fig. 7(b)). For these wings, the effects at supersonic speeds were slight, and not as consistent as those at subsonic speeds.

CONCLUSIONS

From the preceding discussion of the effects of plan form on the aerodynamic characteristics of three wings of aspect ratio 2 at subsonic and supersonic speeds, it is shown that variation in plan form from rectangular to swept back to triangular produces the following effects:

1. Reduces the lift-curve slope
2. Reduces the center-of-pressure travel with Mach number

3. Reduces the minimum drag coefficient at supersonic speeds

4. Increases the maximum lift-drag ratio at supersonic speeds

The minimum drag coefficients of wings at subsonic and supersonic speeds were found to be significantly affected by airfoil-section thickness distribution. The rounded-nose airfoil sections had less drag than biconvex airfoil sections at all subsonic speeds and at supersonic speeds for which the Mach number was less than that for the attachment of the bow wave to the sharp leading edge of the biconvex section.

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TABLE I.— AERODYNAMIC CHARACTERISTICS OF THE RECTANGULAR WING WITH 3-PERCENT-THICK BICONVEX SECTION

M=0.61, R=1.8×10⁶

α	c_L	c_D	c_m
-0.27	-0.024	0.0099	0
-.55	-.034	.0096	.002
-.82	-.048	.0096	.004
-1.07	-.062	.0100	-.005
-2.15	-.117	.0123	-.009
-3.23	-.174	.0167	-.013
-4.30	-.236	.0240	-.016
.25	-.002	.0106	.001
.51	.013	.0100	.003
.78	.026	.0108	.004
1.05	.039	.0104	.005
2.12	.095	.0130	.008
3.20	-.154	.0153	.011
4.27	.212	.0205	.015
6.41	.338	.0393	.017
8.55	.480	.0715	.002
10.69	.617	.1165	-.029
12.81	.731	.1673	-.054
14.89	.814	.2211	.084

M=0.71, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.022	0.0107	-0.001
-.55	-.033	.0100	-.003
-.82	-.046	.0097	-.005
-1.08	-.061	.0098	-.007
-2.17	-.118	.0126	-.012
-3.25	-.181	.0172	-.016
-4.33	-.246	.0243	-.020
.29	-.002	.0110	.001
.52	.015	.0108	.003
.80	.029	.0106	.004
1.06	.042	.0106	.005
2.14	.100	.0124	.011
3.23	.162	.0162	.015
4.31	.226	.0225	.020
6.46	.361	.0428	.024
8.62	.510	.0790	.004
10.76	.642	.1232	-.031
12.85	.739	.1754	-.068

M=0.81, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.020	0.0105	-0.003
-.55	-.031	.0100	-.006
-.82	-.046	.0099	-.008
-1.08	-.061	.0102	-.009
-2.19	-.120	.0128	-.016
-3.26	-.187	.0182	-.021
-4.35	-.257	.0256	-.026
.25	-.010	.0104	.001
.53	.017	.0103	.003
.80	.030	.0106	.005
1.06	.044	.0106	.007
2.13	.105	.0129	.014
3.26	.179	.0161	.018
4.34	.243	.0224	.023
6.53	.391	.0460	.035
8.68	.534	.0835	.003
10.81	.656	.1315	-.041
12.86	.716	.1760	-.076
14.92	.777	.2239	-.102

M=0.91, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.016	0.0100	-0.006
-.54	-.027	.0100	-.010
-.82	-.042	.0100	-.012
-1.08	-.056	.0102	-.014
-2.19	-.123	.0126	-.025
-3.31	-.197	.0176	-.031
-4.40	-.267	.0278	-.034
-.25	0	.0107	.002
.53	.016	.0108	.004
.80	.033	.0109	.008
1.08	.047	.0106	.009
2.18	.110	.0121	.021
3.28	.186	.0160	.028
4.39	.268	.0247	.031
6.61	.455	.0562	.016

M=0.93, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.014	0.0099	-0.008
-.54	-.026	.0102	-.011
-.82	-.039	.0106	-.015
-1.08	-.055	.0108	-.017
-2.19	-.120	.0120	-.028
-3.31	-.199	.0179	-.033
-4.42	-.267	.0236	-.031
.25	-.004	.0111	0
.53	.018	.0112	.006
.79	.033	.0112	.008
1.08	.047	.0113	.011
3.29	.187	.0162	.031
4.40	.271	.0259	.030
6.63	.473	.0626	-.003

M=1.20, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.029	0.0172	0.002
-.54	-.046	.0171	.002
-.82	-.064	.0175	.003
-1.08	-.082	.0180	.003
-2.16	-.152	.0219	.008
-3.20	-.220	.0286	.013
-4.26	-.291	.0394	.020
.25	-.006	.0173	.001
.53	.027	.0175	0*
.79	.045	.0174	-.001
1.07	.064	.0178	-.001
2.14	.133	.0211	-.005
3.19	.202	.0272	-.010
4.25	.272	.0362	-.017
6.35	.421	.0618	-.033
8.46	.568	.0990	-.051

M=1.30, R=1.8×10⁶

α	c_L	c_D	c_m
-0.28	-0.026	0.0162	0.003
-.54	-.042	.0165	.004
-.81	-.058	.0172	.005
-1.08	-.075	.0175	.007
-2.14	-.141	.0220	.012
-3.19	-.207	.0289	.018
-4.24	-.272	.0361	.026
.25	.006	.0162	0
.53	.025	.0162	-.002
.79	.041	.0169	-.003
1.06	.058	.0174	-.004
2.13	.125	.0210	-.010
3.19	.190	.0272	-.016
4.23	.257	.0355	-.023
6.33	.384	.0601	-.038
8.43	.511	.0935	-.054
10.51	.635	.1358	-.074
12.60	.749	.1785	-.091

M=1.40, R=1.8×10⁶

α	c_L	c_D	c_m
-0.27	-0.017	0.0158	0.002
-.54	-.036	.0159	.004
-.81	-.052	.0160	.005
-1.08	-.069	.0166	.007
-2.14	-.127	.0205	.013
-3.18	-.189	.0258	.021
-4.23	-.251	.0358	.029
.25	.006	.0158	0
.53	.023	.0154	-.002
.79	.037	.0160	-.003
1.06	.053	.0164	-.005
2.12	.113	.0197	-.012
3.17	.170	.0253	-.020
4.21	.236	.0335	-.027
6.31	.361	.0565	-.042
8.41	.482	.0891	-.059
10.49	.600	.1291	-.078
12.58	.710	.1767	-.096
14.67	.815	.2319	-.113
16.74	.915	.2936	-.132
17.78	.964	.3275	-.141

M=1.50, R=1.8×10⁶

α	c_L	c_D	c_m
-0.27	-0.017	0.0149	0.001
-.54	-.031	.0151	.003
-.79	-.046	.0155	.004
-1.33	-.074	.0161	.007
-2.13	-.115	.0191	.012
-3.17	-.171	.0248	.019
-4.21	-.229	.0327	.027
.25	.008	.0143	-.001
.53	.021	.0143	-.002
.79	.037	.0146	-.004
1.06	.050	.0150	-.005
2.11	.107	.0179	-.011
3.17	.159	.0232	-.019
4.21	.221	.0305	-.026
6.29	.335	.0520	-.041
8.38	.452	.0823	-.056
10.45	.554	.1203	-.076
12.56	.677	.1672	-.095
14.64	.782	.2207	-.113
16.72	.882	.2817	-.130
17.76	.930	.3143	-.137

M=1.60, R=1.8×10⁶

α	c_L	c_D	c_m
-0.27	-0.020	0.0129	0.003
-.54	-.013	.0132	.004
-.81	-.047	.0136	.006
-1.06	-.060	.0141	.008
-2.12	-.114	.0175	.015
-3.17	-.165	.0234	.023
-4.21	-.205	.0337	.032
.25	.003	.0131	0
.52	.018	.0131	-.002
.79	.031	.0134	-.003
1.04	.045	.0138	-.005
2.10	.096	.0164	-.012
3.15	.143	.0213	-.020
4.19	.201	.0281	-.028
6.25	.308	.0480	-.044
8.36	.421	.0768	-.062
10.44	.528	.1198	-.077
12.53	.639	.1561	-.097
14.61	.741	.2095	-.115
16.70	.840	.2688	-.133
17.73	.887	.2992	-.141

M=1.70, R=1.8×10⁶

α	c_L	c_D	c_m
-0.27	-0.017	0.0129	0.003
-.54	-.029	.0132	.004
-.82	-.038	.0135	.006
-1.02	-.074	.0140	.008
-2.11	-.103	.0170	.015
-3.15	-.154	.0223	.024
-4.19	-.205	.0293	.032
.25	.005	.0129	0
.52	.018	.0129	-.002
.74	.031	.0131	-.004
1.04	.044	.0134	-.006
2.10	.094	.0160	-.013
3.15	.143	.0206	-.021
4.18	.193	.0268	-.029
6.24	.293	.0450	-.045
8.30	.395	.0713	-.062
10.42	.496	.1096	-.076
12.43	.606	.1483	-.095
14.59	.703	.1977	-.113
16.58	.796	.2588	-.130
17.70	.845	.2840	-.140

M=1.90, R=1.8×10⁶

α	c_L	c_D	c_m
-0.26	-0.016	0.0160	0.003
-.53	-.046	.0158	.004
-.79	-.038	.0156	.006
-1.05	-.049	.0157	.008
-2.10	-.092	.0181	.016
-3.14	-.137	.0225	.024
-4.17	-.183	.0285	.032
.26	.003	.0134	0
.51	.016	.0136	-.002
.78	.027	.0135	-.004
1.04	.038	.0140	-.006
2.08	.082	.0160	-.013
3.13	.126	.0206	-.021
4.16	.170	.0259	-.029
6.25	.258	.0412	-.045
8.30	.350	.0648	-.062
10.36	.441	.0946	-.079
12.43	.537	.1329	-.096
14.51	.635	.1791	-.113
16.58	.720	.2299	-.127
17.62	.770	.2592	-.136

M=0.61, R=4.4×10⁶

α	c_L	c_D	c_m
-0.30	-0.020	0.0104	-0.004
-.59	-.034	.0103	-.005
-.87	-.048	.0101	-.007
-1.15	-.061	.0102	-.009
-2.27	-.115	.0125	-.014
-3.38	-.174	.0174	-.019
-4.50	-.235	.0247	-.025
.29	.005	.0103	.001
.56	.020	.0104	.002
.84	.034	.0102	.005
1.12	.047	.0103	.006
2.24	.101	.0125	.012
3.36	.161	.0169	.018
4.47	.221	.0230	.023
6.74	.360	.0454	.025
8.85	.500	.0881	.006

M=0.71, R=4.4×10⁶

α	c_L	c_D	c_m
-0.31	-0.023	0.0102	-0.004
-.60	-.037	.0101	-.006
-.90	-.050	.0100	-.008
-1.19	-.064	.0102	-.009
-2.30	-.120	.0125	-.016
-3.43	-.181	.0171	-.023
-4.57	-.247	.0241	-.027
.28	.007	.0102	.001
.56	.023	.0101	.003
.85	.035	.0099	.005
1.15	.050	.0101	.007
2.27	.107	.0121	.013
3.41	.170	.0162	.021
4.55	.233	.0236	.025
6.81	.364	.0451	.025

M=0.81, R=4.4×10⁶

α	c_L	c_D	c_m
-0.31	-0.024	0.0104	-0.004
-.61	-.037	.0103	-.006
-.90	-.052	.0103	-.009
-1.20	-.126	.0106	-.011
-2.34	-.126	.0129	-.019
-3.50	-.190	.0190	-.026
-4.66	-.277	.0277	-.033
.26	.007	.0103	-.001
.56	.021	.0101	.003
.86	.038	.0101	.006
1.15	.053	.0101	.008
2.31	.113	.0125	.016
3.47	.181	.0171	.024
4.63	.254	.0256	.030

M=0.91, R=4.4×10⁶

α	c_L	c_D	c_m
-0.35	-0.031	0.0103	-0.006
-.65	-.045	.0105	-.009
-.95	-.060	.0103	-.011
-1.23	-.077	.0111	-.015
-2.41	-.145	.0131	-.028
-3.60	-.221	.0198	-.035
-4.83	-.316	.0321	-.033
.29	.003	.0105	.002
.60	.030	.0104	.005
.89	.044	.0104	.007
1.20	.062	.0106	.011
2.38	.135	.0127	.024
3.55	.205	.0180	.031
4.77	.301	.0297	.028

M=1.20, R=4.4×10⁶

α	c_L	c_D	c_m
-0.33	-0.032	0.0181	0.001
-.65	-.050	.0184	.002
-.93	-.069	.0188	.003
-1.22	-.085	.0196	.004
-2.36	-.160	.0232	.008
-3.51	-.232	.0318	.015
-4.65	-.309	.0424	.024
.28	.011	.0182	0
.61	.034	.0183	-.001
.90	.054	.0187	-.002
1.19	.073	.0193	-.003
2.33	.144	.0230	-.008
3.48	.219	.0296	-.014
4.62	.292	.0394	-.022
6.02	.384	.0555	-.033

M=1.30, R=4.4×10⁶

α	c_L	c_D	c_m
-0.33	-0.029	0.0179	0.003
-.65	-.045	.0182	.004
-.92	-.064	.0189	.006
-1.20	-.081	.0195	.007
-2.36	-.149	.0245	.013
-3.48	-.218	.0322	.021
-4.62	-.290	.0426	.030
.29	.012	.0178	-.001
.59	.033	.0181	-.003
.89	.051	.0186	-.005
1.17	.070	.0192	-.007
2.32	.137	.0237	-.013
3.45	.207	.0308	-.020
4.59	.277	.0404	-.029
6.62	.398	.0641	-.045

M=1.40, R=4.4×10⁶

α	c_L	c_D	c_m
-0.31	-0.024	0.0164	0.003
-.60	-.040	.0168	.004
-.91	-.057	.0174	.006
-1.19	-.074	.0181	.008
-2.30	-.135	.0222	.015
-3.43	-.199	.0292	.022
-4.57	-.270	.0398	.033
.28	.010	.0164	-.001
.58	.031	.0167	-.003
.88	.046	.0171	-.005
1.17	.062	.0177	-.007
2.29	.124	.0215	-.013
3.41	.189	.0281	-.020
4.54	.255	.0374	-.029
6.81	.387	.0634	-.046
7.34	.417	.0708	-.050

M=1.50, R=4.4×10⁶

α	c_L	c_D	c_m
-0.31	-0.020	0.0154	0.002
-.60	-.034	.0157	.004
-.89	-.050	.0161	.006
-1.17	-.065	.0167	.007
-2.30	-.124	.0207	.015
-3.41	-.182	.0271	.023
-4.54	-.245	.0365	.032
.29	.011	.0153	-.002
.58	.029	.0156	-.004
.88	.045	.0161	-.006
1.17	.060	.0168	-.008
2.28	.117	.0203	-.016
3.40	.177	.0251	-.023
4.52	.239	.0346	-.032
6.77	.363	.0593	-.050
7.73	.416	.0727	-.057

M=1.60, R=4.4×10⁶

α	c_L	c_D	c_m
-0.31	-0.018	0.0142	0.003
-.60	-.032	.0145	.004
-.89	-.047	.0150	.006
-1.17	-.060	.0154	.008
-2.28	-.115	.0191	.015
-3.39	-.171	.0250	.023
-4.50	-.228	.0333	.033
.28	.010	.0140	-.001
.58	.025	.0143	-.003
.87	.041	.0147	-.005
1.15	.055	.0151	-.007
2.26	.109	.0181	-.014
3.36	.165	.0221	-.022
4.48	.222	.0321	-.032
6.72	.338	.0550	-.050
8.51	.435	.0805	-.064

M=1.70, R=4.4×10⁶

α	c_L	c_D	c_m
-0.29	-0.017	0.0137	0.003
-.58	-.030	.0140	.005
-.86	-.044	.0144	.007
-1.15	-.057	.0150	.009
-2.25	-.107	.0183	.017
-3.34	-.158	.0237	.025
-4.44	-.212	.0314	.034
.28	.011	.0133	-.002
.57	.026	.0134	-.004
.85	.040	.0138	-.006
1.14	.052	.0143	-.008
2.43	.103	.0172	-.016
3.33	.155	.0225	-.024
4.43	.206	.0896	-.033
6.63	.314	.0510	-.052
8.85	.426	.0813	-.070
9.63	.464	.0939	-.076

NACA

TABLE II.- AERODYNAMIC CHARACTERISTICS OF THE RECTANGULAR WING WITH 3-PERCENT-THICK ROUNDED-NOSE SECTION

M=0.61, R=1.8×10⁶

α	C_L	C_D	C_m
-0.87	-0.086	0.0072	0
-.55	-.040	.0076	-.002
-.82	-.054	.0079	-.003
-1.07	-.062	.0082	-.005
-2.15	-.118	.0098	-.010
-3.23	-.172	.0138	-.013
-4.30	-.233	.0202	-.017
.29	-.005	.0071	.004
.50	.010	.0077	.006
.78	.023	.0079	.007
1.05	.036	.0080	.008
2.12	.093	.0109	.012
3.19	.150	.0143	.016
4.27	.208	.0203	.019
6.42	.334	.0412	.024
8.56	.476	.0743	.014
10.69	.606	.1180	-.013
12.80	.719	.1698	-.053
14.90	.812	.2247	-.094
16.96	.868	.2760	-.117
17.97	.879	.2974	-.120

M=0.71, R=1.8×10⁶

α	C_L	C_D	C_m
-0.28	-0.027	0.0079	0
-.56	-.041	.0078	-.002
-.82	-.056	.0079	-.004
-1.10	-.068	.0080	-.005
-2.17	-.122	.0098	-.011
-3.25	-.182	.0140	-.016
-4.33	-.245	.0209	-.020
.29	-.008	.0074	.006
.50	.009	.0074	.008
.78	.021	.0075	.009
1.05	.036	.0079	.010
2.13	.093	.0107	.015
3.22	.157	.0145	.018
4.29	.219	.0209	.021
6.44	.349	.0425	.027
8.60	.491	.0776	.013
10.75	.626	.1244	-.022
12.85	.727	.1758	-.065
14.91	.783	.2229	-.100
16.95	.819	.2666	-.113
18.01	.870	.2994	-.123

M=0.81, R=1.8×10⁶

α	C_L	C_D	C_m
-0.30	-0.031	0.0076	0.001
-.56	-.044	.0077	-.002
-.82	-.058	.0079	-.004
-1.11	-.070	.0082	-.007
-2.18	-.127	.0119	-.014
-3.28	-.191	.0145	-.020
-4.56	-.259	.0221	-.026
.29	-.007	.0076	.005
.50	.008	.0071	.008
.78	.021	.0075	.010
1.06	.035	.0076	.012
2.14	.098	.0107	.018
3.25	.167	.0153	.023
4.33	.235	.0222	.028
6.51	.377	.0449	.036
8.67	.527	.0836	.011
10.80	.639	.1223	-.039
12.86	.708	.1756	-.077
14.91	.751	.2198	-.101

M=0.91, R=1.8×10⁶

α	C_L	C_D	C_m
-0.28	-0.024	0.0072	-0.004
-.56	-.036	.0074	-.007
-.83	-.049	.0077	-.011
-1.09	-.060	.0085	-.015
-2.20	-.124	.0107	-.024
-3.30	-.200	.0163	-.031
-4.41	-.280	.0257	-.033
.25	.002	.0076	.003
.53	.018	.0072	.007
.80	.031	.0077	.009
1.07	.045	.0085	.013
2.18	.112	.0115	.023
3.28	.188	.0173	.026
4.39	.267	.0263	.029
6.62	.463	.0606	.007
8.86	.674	.1163	-.045

M=0.93, R=1.8×10⁶

α	C_L	C_D	C_m
-0.29	-0.026	0.0071	-0.004
-.56	-.038	.0074	-.006
-.83	-.050	.0080	-.013
-1.10	-.061	.0085	-.015
-2.21	-.128	.0107	-.026
-3.31	-.206	.0170	-.030
-4.42	-.292	.0275	-.027
.25	.001	.0075	.003
.53	.018	.0074	.007
.80	.029	.0076	.011
1.07	.043	.0083	.015
2.18	.109	.0112	.025
3.28	.184	.0171	.029
4.39	.270	.0271	.027
6.61	.478	.0612	.001
8.86	.665	.1155	-.049

M=1.20, R=1.8×10⁶

α	C_L	C_D	C_m
-0.28	-0.022	0.0151	0.002
-.54	-.045	.0161	.003
-.81	-.062	.0158	.004
-1.08	-.079	.0172	.004
-2.16	-.148	.0214	.010
-3.21	-.219	.0290	.016
-4.85	-.288	.0374	.023
.25	.006	.0199	-.001
.53	.027	.0160	-.002
.79	.045	.0165	-.003
1.06	.062	.0170	-.004
2.14	.131	.0214	-.004
3.20	.200	.0281	-.014
4.24	.270	.0358	-.024
6.35	.414	.0636	-.039
8.46	.555	.1006	-.056
10.57	.699	.1452	-.077

M=1.30, R=1.8×10⁶

α	C_L	C_D	C_m
-0.27	-0.025	0.0171	0.002
-.54	-.042	.0175	.004
-.81	-.057	.0180	.005
-1.08	-.073	.0187	.006
-2.15	-.138	.0231	.013
-3.19	-.203	.0292	.021
-4.25	-.268	.0383	.026
.25	.009	.0175	-.002
.52	.026	.0177	-.003
.79	.042	.0182	-.004
1.06	.059	.0187	-.006
2.11	.124	.0229	-.012
3.18	.189	.0295	-.020
4.25	.252	.0381	-.028
6.33	.378	.0630	-.044
8.43	.506	.0978	-.061
10.52	.630	.1417	-.082
12.62	.743	.1860	-.100
14.70	.893	.2462	-.120
16.79	.957	.3082	-.140

M=1.40, R=1.8×10⁶

α	C_L	C_D	C_m
-0.27	-0.022	0.0164	0.002
-.54	-.037	.0169	.003
-.81	-.052	.0173	.005
-1.08	-.066	.0181	.006
-2.14	-.125	.0220	.013
-3.18	-.187	.0280	.022
-4.23	-.248	.0360	.030
.25	.008	.0174	-.002
.52	.024	.0174	-.003
.79	.039	.0179	-.005
1.06	.054	.0182	-.007
2.11	.114	.0221	-.014
3.18	.175	.0281	-.022
4.22	.233	.0363	-.030
6.31	.354	.0594	-.048
8.41	.473	.0915	-.066
10.50	.589	.1318	-.084
12.58	.704	.1830	-.104
14.68	.807	.2356	-.122
16.76	.980	.2980	-.140
17.80	.956	.3325	-.149

M=1.50, R=1.8×10⁶

α	C_L	C_D	C_m
-0.26	-0.018	0.0159	0.002
-.54	-.034	.0164	.004
-.80	-.047	.0168	.005
-1.06	-.060	.0174	.007
-2.13	-.116	.0212	.014
-3.18	-.174	.0269	.023
-4.22	-.231	.0345	.031
.25	.009	.0167	-.002
.52	.024	.0168	-.006
.79	.038	.0172	-.007
1.06	.052	.0177	-.009
2.11	.107	.0210	-.015
3.16	.164	.0265	-.025
4.20	.218	.0341	-.033
6.30	.331	.0560	-.050
8.39	.445	.0862	-.069
10.48	.556	.1243	-.088
12.56	.667	.1711	-.108
14.66	.771	.2247	-.126
16.74	.871	.2856	-.143
17.79	.917	.3182	-.150

M=1.60, R=1.8×10⁶

α	C_L	C_D	C_m
-0.26	-0.016	0.0153	0.002
-.54	-.030	.0154	.003
-.79	-.042	.0159	.005
-1.06	-.055	.0165	.007
-2.11	-.108	.0195	.014
-3.16	-.161	.0250	.023
-4.20	-.214	.0323	.031
.25	.009	.0155	-.002
.52	.023	.0156	-.004
.79	.036	.0159	-.005
1.06	.049	.0164	-.007
2.11	.101	.0197	-.015
3.16	.154	.0250	-.023
4.20	.205	.0321	-.032
6.28	.310	.0522	-.048
8.36	.416	.0804	-.066
10.45	.523	.1168	-.085
12.53	.632	.1617	-.106
14.63	.734	.2134	-.124
16.71	.831	.2719	-.141
17.76	.881	.3048	-.151

M=1.70, R=1.8×10⁶

α	C_L	C_D	C_m
-0.26	-0.015	0.0155	0.008
-.54	-.026	.0156	.001
-.79	-.040	.0161	.005
-1.06	-.052	.0166	.007
-2.11	-.102	.0195	.015
-3.16	-.152	.0245	.023
-4.20	-.202	.0314	.031
.25	.009	.0155	-.002
.52	.023	.0158	-.004
.79	.034	.0159	-.006
1.06	.046	.0164	-.007
2.11	.097	.0192	-.015
3.16	.148	.0246	-.024
4.19	.196	.0316	-.032
6.27	.295	.0505	-.049
8.33	.395	.0774	-.066
10.43	.496	.1119	-.085
12.52	.599	.1550	-.104
14.60	.696	.2036	-.122
16.68	.794	.2605	-.141
17.73	.842	.2921	-.149

M=1.30, R=1.8×10⁶

α	C_L	C_D	C_m
-0.26	-0.016	0.0167	0.002
-.53	-.029	.0172	.005
-.79	-.041	.0175	.008
-1.07	-.053	.0180	.008
-2.11	-.101	.0909	.016
-3.13	-.152	.0260	.088
-4.17	-.201	.0325	.034
.25	.009	.0170	-.002
.52	.022	.0170	-.006
.78	.034	.0172	-.006
1.04	.046	.0176	-.017
2.10	.096	.0207	-.017
3.13	.145	.0227	-.086
4.17	.194	.0327	-.035
5.36	.262	.0444	-.047
8.30	.393	.0780	-.073
10.38	.495	.1121	-.092
12.46	.598	.1550	-.113
14.53	.688	.2020	-.127
16.60	.786	.2594	-.145
17.64	.838	.2910	-.155

M=0.61, R=4.4×10⁶

α	C_L	C_D	C_m
-0.30	-0.024	0.0090	-0.002
-.60	-.039	.0091	-.003
-.88	-.054	.0091	-.005
-1.17	-.065	.0094	-.006
-2.29	-.122	.0113	-.011
-3.40	-.177	.0154	-.015
-4.51	-.237	.0224	-.019
.25	.005	.0089	.001
.55	.020	.0090	.003
.84	.034	.0093	.004
1.12	.049	.0094	.006
2.25	.101	.0112	.011
3.36	.161	.0149	.016
4.47	.217	.0213	.021
6.72	.347	.0438	.026
9.00	.494	.0807	.011

M=0.71, R=4.4×10⁶

α	C_L	C_D	C_m
-0.32	-0.026	0.0087	-0.003
-.61	-.042	.0092	-.005
-.91	-.055	.0093	-.006
-1.19	-.070	.0097	-.007
-2.32	-.125	.0116	-.013
-3.45	-.186	.0161	-.018
-4.55	-.248	.0230	-.023
.25	.008	.0088	.001
.56	.021	.0090	.003
.85	.037	.0092	.005
1.14	.052	.0093	.007
2.27	.108	.0115	.013
3.41	.168	.0153	.019
4.55	.230	.0217	.024
6.85	.372	.0469	.025
8.83	.511	.0826	.004

M=0.81, R=4.4×10⁶

α	C_L	C_D	C_m
-0.34	-0.027	0.0083	-0.003
-.63	-.044	.0087	-.005
-.91	-.058	.0089	-.007
-1.23	-.073	.0093	-.009
-2.36	-.131	.0120	-.016
-3.41	-.201	.0170	-.024
-4.68	-.270	.0257	-.030
.27	.003	.0083	.003
.57	.024	.0086	.004
.86	.038	.0088	.006
1.16	.053	.0089	.008
2.31	.115	.0114	.016
3.45	.180	.0158	.024
4.74	.250	.0245	.031
7.01	.412	.0520	.038

M=0.91, R=4.4×10⁶

α	C_L	C_D	C_m
-0.35	-0.031	0.0083	-0.004
-.65	-.045	.0087	-.008
-.94	-.061	.0091	-.010
-1.23	-.077	.0095	-.013
-2.41	-.139	.0123	-.026
-3.61	-.225	.0196	-.030
-4.82	-.312	.0311	-.028
.27	.007	.0089	.005
.58	.024	.0087	.006
.89	.041	.0090	.009
1.18	.055	.0091	.012
2.37	.124	.0118	.023
3.55	.200	.0178	.031
4.79	.300	.0305	.027
6.02	.397	.0468	.021

M=0.93, R=4.4×10⁶

α	C_L	C_D	C_m
-0.34	-0.030	0.0056	-0.005
-.63	-.046	.0090	-.009
-.93	-.062	.0093	-.012
-1.21	-.077	.0097	-.014
-2.37	-.151	.0132	-.024
-3.56	-.240	.0216	-.028
-4.77	-.341	.0393	-.013
.26	.005	.0089	.004
.57	.029	.0088	.008
.87	.041	.0089	.010
1.17	.056	.0092	.014
2.33	.127	.0121	.024
3.51	.212	.0189	.027
4.71	.314	.0324	.017

M=1.20, R=4.4×10⁶

α	C_L	C_D	C_m
-0.28	-0.038	0.0176	0.002
-.64	-.052	.0179	.003
-.93	-.071	.0185	.004
-1.22	-.088	.0192	.006
-2.37	-.161	.0240	.011
-3.45	-.232	.0313	.017
-4.67	-.309	.0422	.025
.28	.010	.0176	-.001
.59	.033	.0173	-.002
.89	.050	.0182	-.004
1.27	.069	.0190	-.006
2.33	.143	.0230	-.010
3.47	.213	.0301	-.015
4.63	.288	.0408	-.023
6.65	.425	.0664	-.044

M=1.30, R=4.4×10⁶

α	C_L	C_D	C_m
-0.33	-0.028	0.0186	0.003
-.61	-.047	.0190	.004
-.92	-.064	.0195	.005
-1.21	-.082	.0202	.008
-2.33	-.149	.0247	.015
-3.49	-.219	.0322	.024
-4.63	-.287	.0423	.032
.29	.011	.0186	-.001
.59	.032	.0188	-.003
.89	.049	.0193	-.005
1.17	.064	.0199	-.006
2.31	.134	.0240	-.013
3.45	.200	.0310	-.021
4.58	.269	.0406	-.030
6.86	.405	.0689	-.049

M=1.40, R=4.4×10⁶

α	C_L	C_D	C_m
-0.32	-0.026	0.0185	0.003
-.61	-.042	.0188	.005
-.91	-.059	.0193	.007
-1.19	-.074	.0198	.009
-2.32	-.137	.0239	.016
-3.45	-.201	.0306	.025
-4.57	-.265	.0401	.035
.28	.010	.0185	-.001
.58	.029	.0186	-.003
.89	.045	.0191	-.005
1.17	.060	.0196	-.007
2.29	.124	.0233	-.014
3.42	.186	.0297	-.022
4.55	.250	.0387	-.032
6.81	.376	.0644	-.050
7.29	.405	.0717	-.055

M=1.50, R=4.4×10⁶

α	C_L	C_D	C_m
-0.31	-0.022	0.0178	0.003
-.61	-.036	.0181	.005
-.90	-.054	.0185	.007
-1.18	-.066	.0191	.009
-2.30	-.126	.0230	.016
-3.42	-.183	.0291	.025
-4.54	-.245	.0381	.035
.29	.012	.0175	-.001
.58	.029	.0179	-.003
.88	.044	.0183	-.006
1.16	.060	.0187	-.008
2.29	.118	.0223	-.015
3.40	.175	.0283	-.023
4.53	.235	.0366	-.033
6.77	.351	.0605	-.050
9.03	.474	.0949	-.071

M=1.60, R=4.4×10⁶

α	C_L	C_D	C_m
-0.31	-0.020	0.0164	0.004
-.60	-.034	.0167	.006
-.88	-.048	.0173	.008
-1.16	-.062	.0177	.010
-2.27	-.116	.0213	.018
-3.38	-.170	.0273	.026
-4.49	-.228	.0355	.036
.29	.012	.0163	-.001
.57	.026	.0165	-.003
.86	.040	.0169	-.005
1.15	.055	.0175	-.007
2.26	.110	.0210	-.015
3.37	.162	.0265	-.023
4.48	.219	.0341	-.033
6.70	.328	.0556	-.051
8.94	.442	.0883	-.071
9.89	.464	.0948	-.075

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TABLE III.- AERODYNAMIC CHARACTERISTICS OF THE SWEPT-BACK WING WITH 3-PERCENT-THICK BICONVEX SECTION

α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
M=0.61	R=1.9×10⁶			M=0.71	R=1.9×10⁶			M=0.81	R=1.9×10⁶			M=0.91	R=1.9×10⁶			M=0.93	R=1.9×10⁶			M=1.20	R=1.9×10⁶		
-0.27	-0.020	0.0071	-0.001	-0.27	-0.019	0.0077	-0.002	-0.27	-0.019	0.0078	-0.003	-0.27	-0.012	0.0082	-0.007	-0.25	-0.009	0.0085	-0.007	-0.27	-0.028	0.0129	0.003
-.54	-.031	.0072	-.002	-.54	-.029	.0074	-.002	-.54	-.029	.0077	-.005	-.54	-.026	.0082	-.007	-.53	-.020	.0081	-.006	-.53	-.045	.0133	.005
-.79	-.043	.0072	-.001	-.81	-.045	.0076	-.002	-.82	-.045	.0080	-.003	-.81	-.040	.0080	-.007	-.79	-.037	.0083	-.008	-.80	-.060	.0134	.008
-1.06	-.058	.0079	-.001	-1.07	-.060	.0083	-.001	-1.07	-.061	.0082	-.002	-1.07	-.056	.0087	-.007	-1.04	-.054	.0086	-.007	-1.06	-.076	.0140	.010
-2.13	-.111	.0109	-.001	-2.13	-.116	.0110	-.001	-2.16	-.119	.0100	-.002	-2.17	-.121	.0115	-.005	-2.11	-.118	.0113	-.005	-2.11	-.140	.0176	.019
-3.19	-.163	.0146	-.001	-3.22	-.177	.0157	-.001	-3.23	-.183	.0158	.001	-3.25	-.193	.0173	-.004	-3.15	-.189	.0166	-.005	-3.15	-.207	.0238	.029
-4.27	-.230	.0224	.001	-4.29	-.240	.0232	.001	-4.22	-.250	.0236	.002	-4.34	-.271	.0260	-.004	-4.20	-.262	.0248	.003	-4.19	-.275	.0324	.040
.25	-.001	.0079	-.001	.25	-.001	.0079	-.001	.21	0	.0077	0	.21	.002	.0083	-.002	.21	.005	.0081	-.002	.25	-.003	.0127	0
.51	.012	.0075	-.001	.51	.013	.0078	-.001	.52	.013	.0077	0	.51	.012	.0082	.002	.51	.014	.0082	.002	.47	.015	.0128	-.003
.76	.023	.0077	0	.78	.025	.0081	0	.78	.027	.0080	0	.78	.024	.0084	.003	.77	.026	.0084	.001	.78	.032	.0135	-.006
1.04	.036	.0080	-.001	1.04	.039	.0081	0	1.05	.040	.0090	0	1.06	.039	.0088	.004	1.04	.040	.0085	.001	1.03	.048	.0137	-.008
2.11	.091	.0097	-.001	2.12	.097	.0102	-.001	2.13	.100	.0103	-.001	2.15	.104	.0118	-.002	2.10	.106	.0110	.001	2.09	.112	.0163	-.018
3.17	.149	.0140	-.001	3.19	.157	.0157	-.002	3.21	.165	.0151	-.002	3.24	.177	.0160	-.002	3.15	.179	.0160	-.008	3.13	.180	.0216	-.028
4.25	.209	.0204	-.002	4.26	.221	.0216	-.003	4.28	.230	.0222	-.004	4.31	.247	.0238	-.007	4.18	.238	.0239	-.009	4.16	.247	.0292	-.038
6.35	.323	.0393	-.007	6.40	.350	.0426	-.009	6.42	.366	.0447	-.012	6.48	.418	.0533	-.032	6.27	.417	.0503	-.025	6.23	.392	.0523	-.066
8.47	.437	.0663	-.010	8.52	.474	.0737	-.012	8.53	.490	.0770	-.022	8.61	.548	.0894	-.045	8.34	.548	.0863	-.045	8.24	.540	.0865	-.094
10.58	.562	.1060	-.017	10.63	.583	.1115	-.028	10.69	.624	.1201	-.036									10.38	.684	.1323	-.121
12.67	.665	.1497	-.026	12.73	.690	.1580	-.037	12.76	.699	.1629	-.045												
14.77	.763	.2013	-.041	14.80	.774	.2078	-.053																
16.80	.813	.2479	-.071	16.84	.823	.2559	-.083																
17.82	.836	.2736	-.085	17.87	.836	.2781	-.095																

α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
M=1.30	R=1.9×10⁶			M=1.40	R=1.9×10⁶			M=1.50	R=1.9×10⁶			M=1.60	R=1.9×10⁶			M=1.70	R=1.9×10⁶			M=1.90	R=1.9×10⁶		
-0.27	-0.023	0.0130	0.002	-0.27	-0.020	0.0139	0.002	-0.27	-0.016	0.0131	0.002	0.27	-0.018	0.0118	0.002	-0.27	-0.016	0.0118	0.002	-0.27	-0.017	0.0128	0.002
-.53	-.037	.0139	.004	-.53	-.033	.0145	.004	-.53	-.029	.0130	.004	-.53	-.030	.0120	.004	-.52	-.027	.0119	.004	-.52	-.027	.0127	.004
-.79	-.050	.0144	.007	-.78	-.046	.0147	.006	-.78	-.042	.0135	.006	-.78	-.043	.0121	.007	-.78	-.039	.0121	.006	-.78	-.039	.0126	.006
-1.05	-.066	.0149	.009	-1.05	-.061	.0152	.009	-1.05	-.057	.0140	.009	-1.05	-.055	.0124	.009	-1.05	-.049	.0124	.008	-1.05	-.049	.0131	.008
-2.10	-.128	.0182	.019	-2.10	-.117	.0180	.018	-2.09	-.109	.0167	.018	-2.09	-.105	.0154	.018	-2.06	-.099	.0152	.017	-2.09	-.092	.0157	.016
-3.14	-.189	.0238	.025	-3.13	-.173	.0231	.029	-3.13	-.162	.0216	.028	-3.08	-.155	.0200	.026	-3.08	-.146	.0196	.025	-3.07	-.133	.0199	.024
-4.17	-.252	.0319	.041	-4.16	-.235	.0308	.040	-4.11	-.214	.0285	.039	-4.11	-.205	.0267	.036	-4.10	-.190	.0254	.035	-4.05	-.174	.0250	.032
.21	-.001	.0137	-.002	.21	.008	.0137	-.002	.21	.005	.0126	-.002	.21	.004	.0121	-.002	.21	.006	.0112	-.002	.21	0	.0120	-.001
.48	-.017	.0142	-.004	.52	.019	.0140	-.004	.48	.021	.0131	-.004	.48	.018	.0121	-.004	.48	.020	.0114	-.004	.48	.013	.0121	-.003
.74	.032	.0148	-.007	.78	.033	.0145	-.007	.74	.035	.0133	-.006	.74	.031	.0123	-.005	.74	.032	.0117	-.006	.73	.024	.0122	-.006
.99	.048	.0150	-.009	1.03	.047	.0149	-.010	1.00	.047	.0139	-.009	.99	.043	.0124	-.009	.99	.044	.0118	-.009	1.02	.035	.0123	-.006
2.08	.107	.0179	-.019	2.08	.102	.0174	-.018	2.04	.099	.0162	-.018	2.04	.091	.0148	-.017	2.04	.091	.0145	-.017	2.04	.077	.0145	-.016
3.13	.169	.0224	-.029	3.12	.161	.0218	-.029	3.08	.152	.0209	-.028	3.08	.141	.0189	-.026	3.07	.137	.0186	-.026	3.06	.119	.0186	-.023
4.16	.230	.0295	-.040	4.09	.216	.0282	-.040	4.11	.205	.0274	-.038	4.10	.189	.0253	-.036	4.10	.181	.0245	-.035	4.09	.160	.0238	-.031
6.18	.354	.0505	-.065	6.17	.331	.0479	-.064	6.17	.310	.0460	-.060	6.15	.283	.0427	-.056	6.15	.271	.0412	-.051	6.13	.240	.0386	-.048
8.24	.476	.0800	-.092	8.22	.444	.0750	-.089	8.21	.409	.0712	-.082	8.20	.378	.0663	-.077	8.19	.363	.0645	-.071	8.16	.321	.0585	-.065
10.30	.590	.1172	-.115	10.28	.550	.1096	-.112	10.26	.509	.1037	-.105	10.25	.469	.0963	-.097	10.24	.448	.0930	-.093	10.21	.399	.0841	-.081
12.36	.706	.1634	-.139	12.34	.658	.1529	-.136	12.32	.610	.1443	-.128	12.30	.558	.1327	-.116	12.29	.536	.1265	-.113	12.25	.477	.1155	-.098
14.41	.808	.2132	-.162	14.40	.759	.2024	-.158	14.38	.703	.1906	-.148	14.35	.652	.1768	-.135	14.34	.626	.1721	-.136	14.30	.555	.1531	-.115
16.46	.900	.2695	-.180	16.45	.854	.2569	-.178	16.42	.799	.2449	-.169	16.39	.737	.2258	-.157	16.39	.708	.2184	-.150	16.31	.635	.1964	-.131
17.49	.954	.3030	-.193	17.48	.898	.2880	-.186	17.45	.840	.2731	-.177	17.42	.780	.2536	-.166	17.41	.747	.2439	-.158	17.32	.671	.2196	-.138

α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
M=0.61	R=4.8×10⁶			M=0.71	R=4.8×10⁶			M=0.81	R=4.8×10⁶			M=0.91	R=4.8×10⁶			M=0.93	R=4.8×10⁶			M=1.20	R=4.8×10⁶		
-0.29	-0.017	0.0089	-0.003	-0.29	-0.017	0.0089	-0.003	-0.30	-0.019	0.0087	-0.003	-0.29	-0.018	0.0088	-0.002	-0.30	-0.019	0.0090	-0.004	-0.30	-0.023	0.0145	0.003
-.56	-.088	.0091	-.003	-.58	-.029	.0092	-.003	-.58	-.031	.0090	-.003	-.59	-.033	.0088	-.004	-.59	-.034	.0089	-.004	-.58	-.040	.0146	.005
-.83	-.042	.0093	-.003	-.84	-.044	.0094	-.003	-.88	-.046	.0090	-.003	-.88	-.048	.0091	-.004	-.87	-.050	.0092	-.004	-.87	-.058	.0151	.008
-1.12	-.056	.0097	-.003	-1.14	-.059	.0099	-.003	-1.15	-.062	.0096	-.003	-1.17	-.065	.0098	-.003	-1.17	-.066	.0099	-.004	-1.15	-.074	.0156	.010
-2.21	-.111	.0127	-.005	-2.25	-.117	.0130	-.003	-2.27	-.123	.0131	-.002	-2.30	-.133	.0134	-.002	-2.30	-.133	.0135	-.002	-2.23	-.147	.0192	.019
-3.32	-.172	.0173	-.002	-3.39	-.179	.0179	-.001	-3.39	-.190	.0181	-.001	-3.42	-.205	.0193	0	-3.44	-.209	.0201	.001	-3.33	-.208	.0250	.030
-4.41	-.235	.0245	0	-4.46	-.245	.0259	.001	-4.51	-.260	.0270	0	-4.58	-.282	.0290	.005	-4.59	-.294	.0302	.002	-4.42	-.281	.0344	.042
.25	.005	.0093	0	.22	.006	.0091	0	.22	.006	.0089	-.001	.22	.007	.0089	-.001	.23	.009	.0092	-.003	.22	.005	.0146	-.001
.54	.021	.0094	-.001	.55	.022	.0092	-.001	.57	.023	.0089	-.001	.57	.020	.0089	-.001	.51	.025	.0091	-.001	.56	.027	.0146	-.004
.83	.034	.0092	-.001	.83	.035	.0096	-.001	.84	.037	.0089	-.001	.85	.039	.0088	-.001	.85	.040	.0091	0	.84	.043	.0147	-.007
1.10	.047	.0094	-.001	1.12	.049	.0096	-.001	1.12	.051	.0093	-.001	1.14	.058	.0096	-.001	1.14	.055	.0098	-.001	1.12	.056	.0152	-.009
2.21	.103	.0125	-.002	2.22	.108	.0128	-.002	2.25	.113	.0126	-.002	2.27	.120	.0138	-.003	2.28	.125	.0132	-.003	2.22	.126	.0185	-.019
3.29	.163	.0169	-.002	3.32	.170	.0182	-.003	3.36	.178	.0173	-.003	3.41	.195	.0188	-.005	4.56	.200	.0190	-.007	3.31	.194	.0240	-.029
4.40	.225	.0236	-.004	4.44	.235	.0242	-.004	4.48	.247	.0249	-.006	4.55	.270	.0270	-.009	4.56	.283	.0281	-.015	4.40	.267	.0325	-.041
6.60	.356	.0449	-.009	6.67	.373	.0493	-.011	6.74	.393	.0682	-.014	6.48	.440	.0573	-.030					6.60	.416	.0577	-.070
8.79	.478	.0758	-.013	8.88	.493	.0788	-.016	8.95	.516	.0682	-.026	9.07	.566	.0957	-.042					7.81	.505	.0778	-.088
10.96	.589	.1149	-.021	11.07	.605	.1198	-.025	11.01	.634	.1255	-.038												
13.13	.695	.1626	-.031																				

α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m	α	C_L	C_D	C_m
M=1.30	R=4.8×10⁶			M=1.40	R=4.8×10⁶			M=1.50	R=4.8×10⁶			M=1.60	R=4.8×10⁶			M=1.70	R=4.8×10⁶		
-0.30	-0.020	0.0154	0.002	-0.28	-0.018	0.0153	0.002	-0.29	-0.016	0.0146	0.002	-0.28	-0.016	0.0137	0.002	-0.28	-0.015	0.0130	0.002
-.58	-.036	.0156	.005	-.58	-.033	.0155	.005	-.57	-.031	.0148	.005	-.56	-.029	.0139	.004	-.56	-.027	.0135	.004
-.86	-.051	.0157	-.007	-.86	-.048	.0156	.007	-.85	-.043	.0150	.007	-.84	-.042	.0141	.007	-.83	-.040	.0137	.006
-1.13	-.066	.0164	-.010	-1.13	-.063	.0161	.010	-1.12	-.058	.0154	.009	-1.12	-.055	.0146	.009	-1.12	-.052	.0142	.009
-2.23	-.128	.0199	.019	-2.21	-.120	.0191	.019	-2.20	-.112	.0184	.019	-2.19	-.106	.0175	.018	-2.18	-.100	.0170	.018
-3.31	-.193	.0256	.030	-3.29	-.178	.0245	.030	-3.26	-.166	.0231	.029	-3.22	-.157	.0223	.028	-3.20	-.147	.0214	.027
-4.40	-.257	.0329	.042	-4.36	-.240	.0319	.042	-4.32	-.211	.0305	.040	-4.30	-.209	.0291	.039	-4.27	-.193	.0278	.037
.22	.006	.0155	-.002	.22	.006	.0153	-.002	.23	.008	.0147	-.002	.22	.007	.0136	-.002	.22	.008	.0133	-.001
.51	.025	.0155	-.006	.51	.024	.0155	-.005	.51	.024	.0149	-.005	.51	.023	.0138	-.004	.51	.021	.0136	-.004
.80	.042	.0158	-.008	.80	.040	.0158	-.007	.80	.038	.0151	-.007	.79	.036	.0144	-.007	.79	.033	.0138	-.007
1.06	.057	.0161	-.010	1.08	.054	.0161	-.010	1.07	.052	.0157	-.010	1.07	.049	.0146	-.009	1.06	.046	.0142	-.009
2.22	.118	.0192	-.020	2.19	.111	.0188	-.020	2.15	.104	.0188	-.019	2.14	.099	.0172	-.018	2.17	.092	.0168	-.016
3.29	.183	.0244	-.031	3.24	.169	.0234	-.030	3.23	.159	.0229	-.029	3.21	.149	.0216	-.028	3.19	.140	.0208	-.026
4.38	.248	.0322	-.043	4.32	.229	.0307	-.042	4.31	.214	.0305	-.041	4.28	.200	.0279	-.039	4.26	.187	.0269	-.035
6.52	.376	.0545	-.069	6.48	.347	.0511	-.066	6.47	.325	.0494	-.064	6.42	.303	.0463	-.060	6.38	.282	.0442	-.055
8.05	.467	.0765	-.087	8.64	.465	.0811	-.092	8.63	.435	.0768	-.082	8.56	.404	.0720	-.082	8.51	.379	.0684	-.075
																10.63	.463	.0983	-.094

TABLE IV.- AERODYNAMIC CHARACTERISTICS OF THE SWEPT-BACK WING WITH 3-PERCENT-THICK ROUNDED-NOSE SECTION

M=0.61, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.023	0.0072	-0.001
-.54	-.035	.0080	-.001
-.81	-.048	.0085	-.002
-1.07	-.058	.0094	-.002
-2.13	-.112	.0116	-.001
-3.19	-.169	.0161	0
-4.26	-.230	.0231	.005
.25	.002	.0069	0
.51	.014	.0070	-.003
.77	.025	.0073	0
1.04	.038	.0076	0
2.11	.091	.0105	-.002
3.17	.145	.0143	-.002
4.23	.204	.0206	-.003
6.37	.335	.0408	-.007
8.49	.456	.0698	-.012
10.59	.565	.1066	-.019
12.69	.668	.1508	-.029
14.77	.754	.1994	-.042
16.82	.822	.2532	-.073
17.82	.814	.2692	-.087

M=0.71, R=1.9×10^6

α	C_L	C_D	C_m
-0.26	-0.023	0.0074	0
-.54	-.035	.0083	-.001
-.81	-.046	.0087	-.002
-1.05	-.059	.0095	-.002
-2.11	-.116	.0118	-.001
-3.20	-.175	.0166	-.001
-4.24	-.239	.0240	-.001
.25	-.001	.0073	0
.52	.017	.0076	-.001
.80	.029	.0074	-.001
1.06	.043	.0082	0
2.13	.101	.0106	-.001
3.20	.157	.0149	-.005
4.27	.221	.0215	-.004
6.42	.353	.0428	-.010
8.52	.473	.0755	-.018
10.65	.593	.1130	-.026
12.71	.699	.1605	-.041
14.80	.779	.2102	-.059
16.59	.780	.2448	-.082
17.60	.785	.2632	-.093

M=0.81, R=1.9×10^6

α	C_L	C_D	C_m
-0.26	-0.023	0.0068	-0.001
-.54	-.033	.0081	-.002
-.82	-.046	.0083	-.003
-1.08	-.059	.0093	-.003
-2.16	-.119	.0119	-.002
-3.24	-.179	.0169	-.001
-4.31	-.249	.0247	-.001
.21	.002	.0069	-.001
.53	.018	.0073	-.001
.79	.032	.0070	-.001
1.06	.046	.0081	-.001
2.14	.102	.0112	-.001
3.21	.165	.0151	-.003
4.29	.232	.0231	-.006
6.43	.366	.0446	-.013
8.56	.498	.0789	-.026
10.69	.620	.1208	-.040
12.79	.721	.1690	-.057
14.84	.776	.2138	-.079
16.89	.835	.2687	-.117
17.89	.827	.2841	-.122

M=0.91, R=1.9×10^6

α	C_L	C_D	C_m
-0.28	-0.022	0.0071	-0.002
-.55	-.032	.0081	-.004
-.81	-.044	.0088	-.005
-1.08	-.057	.0098	-.007
-2.16	-.118	.0121	-.004
-3.25	-.188	.0177	-.002
-4.34	-.268	.0266	.003
.21	.004	.0070	-.001
.53	.022	.0068	-.001
.80	.036	.0074	-.001
1.06	.048	.0077	.001
2.15	.108	.0111	0
3.24	.176	.0159	-.003
4.31	.249	.0234	-.006
6.48	.411	.0508	-.027
8.62	.549	.0895	-.049

M=0.93, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.019	0.0079	-0.002
-.55	-.029	.0080	-.005
-.81	-.041	.0090	-.006
-1.08	-.056	.0096	-.007
-2.17	-.117	.0121	-.006
-3.25	-.187	.0176	-.007
-4.34	-.273	.0274	.006
.21	.005	.0068	-.001
.53	.021	.0074	-.001
.80	.035	.0076	-.001
1.07	.053	.0080	.002
2.15	.108	.0116	.001
3.24	.177	.0168	-.002
4.32	.254	.0248	-.009

M=1.20, R=1.9×10^6

α	C_L	C_D	C_m
-0.28	-0.025	0.0109	0.004
-.53	-.042	.0115	.006
-.80	-.050	.0123	.008
-1.06	-.062	.0132	.012
-2.11	-.118	.0172	.020
-3.15	-.204	.0232	.031
-4.19	-.273	.0316	.043
.25	0	.0113	0
.52	.018	.0113	-.002
.78	.034	.0117	-.004
1.04	.049	.0121	-.007
2.09	.116	.0156	-.018
3.14	.180	.0214	-.026
4.17	.247	.0288	-.040
6.25	.391	.0521	-.068
8.33	.536	.0851	-.095
10.41	.681	.1307	-.121

M=1.30, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.025	0.0125	0.003
-.53	-.040	.0129	.005
-.80	-.054	.0136	.008
-1.06	-.068	.0143	.010
-2.11	-.127	.0178	.020
-3.14	-.188	.0238	.031
-4.18	-.249	.0317	.043
.21	.002	.0125	-.001
.48	.018	.0126	-.004
.74	.033	.0130	-.006
1.04	.047	.0135	-.009
2.09	.108	.0152	-.019
3.13	.168	.0218	-.030
4.16	.226	.0288	-.041
6.19	.349	.0492	-.066
8.30	.470	.0792	-.092
10.32	.587	.1167	-.117
12.38	.697	.1621	-.141
14.44	.797	.2114	-.162
16.50	.893	.2659	-.183
17.53	.944	.3013	-.193

M=1.40, R=1.9×10^6

α	C_L	C_D	C_m
-0.26	-0.024	0.0124	0.003
-.52	-.038	.0127	.005
-.78	-.051	.0131	.007
-1.04	-.065	.0137	.010
-2.07	-.119	.0174	.020
-3.10	-.177	.0228	.031
-4.13	-.232	.0301	.043
.25	.001	.0123	-.001
.52	.016	.0126	-.004
.77	.030	.0127	-.006
1.02	.044	.0130	-.008
2.06	.099	.0156	-.019
3.09	.156	.0202	-.030
4.12	.212	.0273	-.041
6.18	.325	.0464	-.065
8.23	.436	.0738	-.090
10.30	.544	.1087	-.114
12.36	.651	.1520	-.139
14.42	.749	.2007	-.160
16.48	.838	.2559	-.178
17.51	.881	.2849	-.186

M=1.50, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.022	0.0122	0.005
-.53	-.035	.0125	.005
-.79	-.047	.0128	.007
-1.05	-.060	.0133	.010
-2.09	-.112	.0165	.019
-3.14	-.165	.0217	.030
-4.15	-.217	.0288	.041
.21	.003	.0121	-.001
.48	.016	.0121	-.004
.74	.030	.0125	-.006
1.02	.042	.0127	-.008
2.04	.094	.0151	-.018
3.08	.146	.0192	-.026
4.12	.200	.0259	-.040
6.17	.303	.0442	-.063
8.23	.405	.0695	-.086
10.29	.506	.1019	-.109
12.35	.605	.1418	-.132
14.40	.700	.1878	-.153
16.45	.790	.2404	-.172
17.48	.833	.2690	-.181

M=1.60, R=1.9×10^6

α	C_L	C_D	C_m
-0.26	-0.022	0.0115	0.003
-.52	-.034	.0119	.005
-.78	-.047	.0122	.008
-1.03	-.058	.0126	.010
-2.06	-.108	.0156	.019
-3.09	-.157	.0202	.029
-4.12	-.206	.0271	.039
.25	.001	.0116	-.001
.51	.015	.0117	-.004
.77	.027	.0120	-.006
1.02	.039	.0123	-.008
2.05	.089	.0146	-.018
3.08	.139	.0186	-.028
4.11	.188	.0245	-.039
6.16	.286	.0418	-.060
8.21	.383	.0666	-.082
10.27	.477	.0964	-.103
12.33	.573	.1344	-.125
14.38	.664	.1785	-.146
16.43	.751	.2284	-.166
17.46	.795	.2566	-.172

M=1.70, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.020	0.0120	0.003
-.53	-.032	.0123	.007
-.78	-.043	.0126	.007
-1.05	-.055	.0130	.009
-2.09	-.100	.0156	.018
-3.08	-.147	.0201	.026
-4.11	-.189	.0297	.037
.21	.002	.0119	-.002
.47	.013	.0120	-.003
.74	.026	.0122	-.005
1.00	.037	.0124	-.006
2.05	.084	.0145	-.017
3.08	.132	.0185	-.027
4.10	.177	.0242	-.037
6.16	.267	.0403	-.054
8.20	.357	.0687	-.076
10.25	.445	.0913	-.096
12.30	.534	.1262	-.116
14.36	.621	.1682	-.136
16.41	.704	.2153	-.154
17.44	.745	.2416	-.163

M=1.90, R=1.9×10^6

α	C_L	C_D	C_m
-0.27	-0.022	0.0148	0.003
-.53	-.034	.0150	.005
-.78	-.046	.0152	.008
-1.05	-.058	.0156	.010
-2.04	-.104	.0182	.080
-3.05	-.150	.0226	.029
-4.10	-.195	.0287	.039
.21	0	.0140	-.001
.48	.011	.0141	-.003
.73	.023	.0141	-.006
.99	.036	.0144	-.008
2.04	.084	.0166	-.017
3.07	.129	.0205	-.027
4.09	.173	.0260	-.035
6.17	.235	.0361	-.049
8.17	.353	.0642	-.074
10.28	.442	.0907	-.094
12.27	.528	.1275	-.113
14.32	.617	.1689	-.130
16.37	.706	.2179	-.151
17.39	.747	.2430	-.159

M=0.61, R=4.8×10^6

α	C_L	C_D	C_m
-0.29	-0.015	0.0081	-0.003
-.57	-.029	.0087	-.003
-.84	-.042	.0089	-.003
-1.12	-.055	.0094	-.005
-2.22	-.111	.0122	-.002
-3.32	-.169	.0159	-.001
-4.41	-.231	.0238	0
.22	.006	.0073	-.001
.54	.022	.0075	-.001
.83	.035	.0081	-.001
1.10	.048	.0088	0
2.21	.105	.0114	-.002
3.31	.165	.0156	-.003
4.41	.224	.0820	-.004
6.62	.357	.0439	-.010
8.82	.478	.0745	-.015
10.99	.594	.1150	-.025
13.17	.703	.1658	-.035
15.31	.794	.2166	-.050

M=0.71, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.015	0.0080	-0.003
-.58	-.029	.0086	-.003
-.86	-.042	.0090	-.003
-1.14	-.055	.0094	-.005
-2.24	-.115	.0123	-.002
-3.36	-.177	.0178	-.001
-4.47	-.243	.0849	-.001
.26	.008	.0074	-.001
.54	.024	.0076	-.001
.84	.037	.0082	-.001
1.12	.052	.0090	-.002
2.23	.112	.0118	-.002
3.34	.172	.0161	-.003
4.46	.238	.0234	-.006
6.70	.376	.0469	-.012
8.91	.500	.0799	-.020
11.10	.614	.1217	-.031

M=0.81, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.018	0.0080	-0.003
-.58	-.030	.0082	-.003
-.85	-.043	.0087	-.005
-1.15	-.054	.0093	-.003
-2.27	-.121	.0125	-.002
-3.40	-.185	.0178	-.001
-4.52	-.256	.0261	.003
.28	.011	.0071	-.001
.56	.027	.0074	-.001
.84	.040	.0082	0
1.13	.054	.0087	-.001
2.27	.117	.0118	-.002
3.38	.184	.0168	-.004
4.51	.251	.0247	-.011
6.79	.401	.0510	-.016
9.01	.526	.0865	-.029

M=0.91, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.016	0.0076	-0.003
-.59	-.032	.0081	-.004
-.89	-.046	.0087	-.004
-1.16	-.062	.0093	-.004
-2.30	-.128	.0126	-.002
-3.44	-.199	.0183	0
-4.61	-.286	.0287	.006
.28	.012	.0072	-.002
.58	.030	.0072	-.001
.86	.043	.0080	0
1.15	.058	.0086	-.001
2.29	.123	.0115	-.002
3.43	.197	.0178	-.005
4.58	.273	.0266	-.010
6.88	.436	.0571	-.031
9.14	.585	.1010	-.057

M=0.93, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.016	0.0080	-0.004
-.59	-.032	.0081	-.004
-.89	-.046	.0085	-.005
-1.18	-.063	.0094	-.004
-2.25	-.128	.0127	-.002
-3.45	-.207	.0187	-.007
-4.63	-.298	.0300	.014
.29	.013	.0073	-.002
.59	.031	.0073	-.001
.86	.048	.0080	0
1.15	.060	.0087	-.001
2.30	.130	.0123	-.003
3.44	.204	.0180	-.007
4.60	.286	.0278	-.015

M=1.20, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.025	0.0129	0.003
-.59	-.042	.0133	.006
-.87	-.058	.0139	.008
-1.15	-.074	.0146	.010
-2.25	-.140	.0189	.020
-3.35	-.208	.0251	.031
-4.45	-.282	.0344	.044
.23	.010	.0123	-.002
.56	.030	.0126	-.005
.86	.046	.0133	-.007
1.13	.062	.0140	-.010
2.22	.120	.0179	-.020
3.33	.177	.0238	-.031
4.43	.268	.0322	-.044
6.64	.414	.0577	-.073

M=1.30, R=4.8×10^6

α	C_L	C_D	C_m
-0.30	-0.021	0.0139	0.002
-.58	-.057	.0142	.005
-.86	-.052	.0147	.007
-1.14	-.067	.0154	.010
-2.23	-.129	.0196	.021
-3.32	-.192	.0254	.032
-4.42	-.259	.0340	.045
.23	.010	.0132	-.003
.52	.028	.0133	-.006
.80	.044	.0137	-.008
1.08	.058	.0144	-.011
2.17	.120	.0184	-.022
3.27	.183	.0239	-.033
4.36	.249	.0317	-.046
6.54	.374	.0541	-.072

M=1.40, R=4.8×10^6

α	C_L	C_D	C_m
-0.29	-0.018	0.0135	0.002
-.58	-.034	.0141	.005
-.86	-.048	.0146	.006
-1.13	-.062	.0152	.010
-2.22	-.119	.0188	.021
-3.30	-.178	.0245	.032
-4.35	-.237	.0319	.044
.23	.010	.0131	-.003
.52	.026	.0133	-.006
.80	.041	.0138	-.008
1.08	.056	.0143	-.011
2.16	.118	.0179	-.022
3.25	.171	.0231	-.033
4.34	.230	.0302	-.045
6.50	.345	.0508	-.069
8.67	.460	.0806	-.095

M=1.50, R=4.8×10^6

α	C_L	C_D	C_m
-0.29	-0.017	0.0130	0.002
-.57	-.031	.0136	.005
-.85	-.044	.0141	.007
-1.13	-.058	.0147	.010
-2.20	-.112	.0178	.020
-3.24	-.166	.0230	.031
-4.33	-.223	.0304	.043
.23	.010	.0130	-.003
.52	.024	.0132	-.006
.80	.038	.0136	-.008
1.08	.052	.0141	-.011
2.16	.105	.0173	-.021
3.22	.159	.0220	-.032
4.30	.213	.0288	-.043
6.46	.318	.0480	-.066
8.61	.424	.0792	-.101
9.71	.476	.0921	-.101

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TABLE V.— AERODYNAMIC CHARACTERISTICS OF THE TRIANGULAR WING OF REFERENCE 1

M=0.61, R=3.0×10⁶

α	c_L	c_D	c_m
0	*	0.0070	-0.003
-6.43	-.286	.0361	-.035
-5.36	-.240	.0270	-.036
-4.28	-.187	.0190	-.025
-3.20	-.137	.0132	-.018
-2.14	-.091	.0097	-.011
-1.06	-.048	.0078	-.004
0	-.004	.0067	-.002
1.06	.044	.0084	-.010
2.12	.086	.0105	-.017
3.19	.134	.0137	-.023
4.25	.193	.0202	-.031
5.35	.242	.0274	-.040
6.43	.292	.0368	-.047
8.61	.409	.0633	-.063
10.77	.516	.0956	-.077
12.96	.643	.1460	-.094
15.14	.764	.2023	-.111
17.33	.874	.2641	-.123

M=0.81, R=3.0×10⁶

α	c_L	c_D	c_m
0	-.003	.0067	-.003
-6.51	-.325	.0418	.032
-5.42	-.263	.0297	.041
-4.32	-.203	.0203	.031
-3.43	-.150	.0142	.023
-2.16	-.097	.0101	.013
-1.08	-.050	.0079	.005
0	-.004	.0068	-.003
1.07	.048	.0082	-.011
2.15	.100	.0110	-.020
3.23	.149	.0157	-.029
4.31	.206	.0211	-.039
5.41	.265	.0301	-.046
6.51	.314	.0424	-.061
8.72	.467	.0746	-.083
10.91	.585	.1135	-.105
13.11	.706	.1698	-.125
15.32	.837	.2260	-.143
17.46	.925	.2893	-.166

M=0.91, R=3.0×10⁶

α	c_L	c_D	c_m
0	.001	.0074	-.004
-6.57	-.356	.0467	.069
-5.45	-.281	.0322	.051
-4.35	-.221	.0229	.039
-3.26	-.162	.0156	.028
-2.18	-.102	.0108	.016
-1.05	-.052	.0083	.006
-.004	-.004	.0075	-.003
1.08	.051	.0087	-.012
2.17	.103	.0115	-.022
3.25	.164	.0165	-.035
4.35	.223	.0239	-.048
5.45	.286	.0334	-.060
6.56	.367	.0486	-.061
8.80	.519	.0874	-.126

M=1.30, R=3.0×10⁶

α	c_L	c_D	c_m
0	-.003	.0092	-.001
-6.19	-.290	.0392	.073
-5.16	-.243	.0300	.061
-4.13	-.193	.0225	.048
-3.09	-.142	.0168	.035
-2.06	-.095	.0129	.022
-1.03	-.047	.0102	.010
0	-.003	.0094	-.001
1.03	.041	.0105	-.012
2.06	.087	.0131	-.024
3.09	.135	.0170	-.037
4.12	.185	.0227	-.050
5.16	.239	.0304	-.064
6.19	.287	.0395	-.076
8.26	.365	.0633	-.101
10.32	.478	.0934	-.125
12.38	.570	.1297	-.151
14.46	.720	.1877	-.210

M=1.40, R=3.0×10⁶

α	c_L	c_D	c_m
0	-.002	.0104	-.001
-6.19	-.262	.0398	.071
-5.16	-.236	.0308	.060
-4.14	-.168	.0235	.047
-3.09	-.139	.0178	.034
-2.06	-.093	.0138	.022
-1.03	-.049	.0113	.010
0	-.005	.0104	-.001
1.03	.044	.0113	-.014
2.06	.089	.0140	-.025
3.09	.132	.0178	-.037
4.12	.182	.0235	-.050
5.16	.233	.0310	-.063
6.18	.280	.0401	-.075
8.25	.373	.0630	-.099
10.32	.499	.0917	-.121
12.37	.539	.1253	-.142
14.44	.620	.1653	-.161
16.50	.697	.2100	-.179

M=1.53, R=3.0×10⁶

α	c_L	c_D	c_m
-.01	-.006	.0375	.065
-6.18	-.260	.0375	.072
-5.15	-.219	.0293	.057
-4.12	-.176	.0225	.044
-3.09	-.130	.0171	.032
-2.06	-.087	.0133	.021
-1.03	-.045	.0107	.010
0	-.005	.0096	0
1.03	.044	.0110	-.013
2.06	.087	.0136	-.024
3.09	.129	.0177	-.036
4.12	.173	.0228	-.047
5.15	.219	.0293	-.058
6.18	.261	.0379	-.069
8.24	.343	.0588	-.090
10.30	.426	.0853	-.110
12.37	.502	.1171	-.130
14.42	.571	.1528	-.147
16.48	.648	.1954	-.163

M=1.60, R=3.0×10⁶

α	c_L	c_D	c_m
0	-0.003	0.0088	-0.001
-6.18	-.251	.0355	.063
-5.15	-.210	.0276	.053
-4.11	-.167	.0210	.042
-3.08	-.124	.0160	.030
-2.06	-.084	.0125	.020
-1.03	-.043	.0098	.009
0	-.003	.0092	0
1.02	.037	.0101	-.012
2.05	.082	.0128	-.023
3.06	.123	.0165	-.031
4.11	.165	.0215	-.045
5.14	.207	.0278	-.057
6.17	.249	.0358	-.066
8.23	.329	.0577	-.086
10.29	.403	.0805	-.105
12.34	.475	.1101	-.123
14.41	.550	.1461	-.142
16.47	.618	.1857	-.157

M=1.70, R=3.0×10⁶

α	c_L	c_D	c_m
0	-.001	0.0097	-.001
-6.17	-.239	.0349	.059
-5.14	-.202	.0274	.050
-4.12	-.162	.0213	.040
-3.09	-.120	.0163	.029
-2.05	-.080	.0128	.019
-1.03	-.041	.0102	.009
0	-.003	.0094	-.001
1.03	.040	.0104	-.012
2.05	.080	.0131	-.022
3.08	.120	.0167	-.032
4.11	.160	.0215	-.042
5.13	.201	.0278	-.053
6.16	.242	.0353	-.063
8.22	.316	.0548	-.081
10.28	.383	.0770	-.098
12.33	.455	.1062	-.115
14.39	.523	.1396	-.138
16.44	.590	.1778	-.146

M=0.61, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	-.002	0.0050	-.003
-6.69	-.299	.0376	.042
-5.56	-.245	.0273	.034
-4.43	-.198	.0189	.026
-3.31	-.144	.0141	.019
-2.22	-.096	.0107	.012
-1.12	-.053	.0090	.005
-.02	-.004	.0082	-.001
1.11	.058	.0092	-.010
2.21	.098	.0212	-.018
3.32	.146	.0144	-.025
4.44	.196	.0200	-.034
5.56	.252	.0280	-.042
6.68	.306	.0379	-.050
8.96	.426	.0663	-.065

M=0.81, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	-.003	0.0075	-.003
-6.84	-.336	.0432	.053
-5.70	-.271	.0311	.043
-4.55	-.214	.0219	.034
-3.40	-.157	.0151	.024
-2.27	-.104	.0111	.015
-1.14	-.055	.0091	.006
-.01	-.002	.0078	-.001
1.13	.056	.0091	-.012
2.26	.109	.0115	-.018
3.39	.163	.0157	-.031
4.55	.220	.0225	-.041
5.69	.278	.0316	-.050
6.85	.342	.0439	-.062
7.28	.358	.0481	-.064

M=0.91, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	.002	0.0076	-.004
-6.54	-.335	.0422	.062
-5.77	-.297	.0348	.053
-4.61	-.231	.0243	.041
-3.45	-.172	.0169	.030
-2.31	-.112	.0118	.018
-1.17	-.060	.0093	.007
-.01	.001	.0077	-.004
1.15	.061	.0093	-.014
2.29	.117	.0115	-.025
3.45	.174	.0174	-.037
4.59	.238	.0250	-.050
5.77	.307	.0362	-.063
6.22	.335	.0413	-.070

M=1.30, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	-.004	0.0099	0
-6.54	-.303	.0422	.075
-5.43	-.250	.0319	.062
-4.36	-.200	.0236	.049
-3.32	-.150	.0179	.036
-2.18	-.100	.0138	.023
-1.10	-.051	.0116	.011
-.01	-.006	.0100	0
1.09	.049	.0115	-.013
2.17	.100	.0143	-.026
3.26	.150	.0182	-.039
4.34	.199	.0241	-.052
5.44	.249	.0321	-.065
6.54	.300	.0421	-.077

M=1.40, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	-.002	0.0112	-.001
-6.53	-.287	.0412	.072
-5.44	-.238	.0316	.060
-4.35	-.190	.0240	.046
-3.26	-.144	.0185	.036
-2.18	-.097	.0149	.023
-1.10	-.050	.0126	.011
-.01	-.004	.0110	-.001
1.08	.050	.0124	-.015
2.17	.099	.0152	-.027
3.26	.146	.0190	-.040
4.34	.193	.0247	-.052
5.43	.241	.0322	-.061
6.52	.289	.0414	-.076

M=1.53, R=7.5×10⁶

α	c_L	c_D	c_m
-.01	.001	0.0107	-.001
-6.50	-.267	.0391	.067
-5.41	-.224	.0299	.057
-4.33	-.180	.0230	.046
-3.25	-.136	.0179	.034
-2.17	-.092	.0144	.022
-1.10	-.048	.0122	.011
-.01	-.003	.0109	0
1.09	.048	.0123	-.014
2.17	.094	.0145	-.026
3.25	.139	.0186	-.037
4.33	.183	.0238	-.049
5.41	.227	.0308	-.060
6.50	.270	.0395	-.070

M=1.60, R=7.5×10⁶

α	c_L	c_D	c_m
0	-.002	0.0106	-.001
-6.48	-.260	.0363	.056
-5.41	-.219	.0292	.055
-4.32	-.176	.0224	.044
-3.25	-.134	.0175	.033
-2.17	-.090	.0140	.022
-1.20	-.048	.0118	.011
-.01	-.004	.0107	0
1.08	.046	.0118	-.013
2.16	.090	.0143	-.023
3.24	.134	.0179	-.036
4.32	.177	.0231	-.047
5.40	.219	.0299	-.058
6.48	.262	.0383	-.065

M=1.70, R=7.5×10⁶

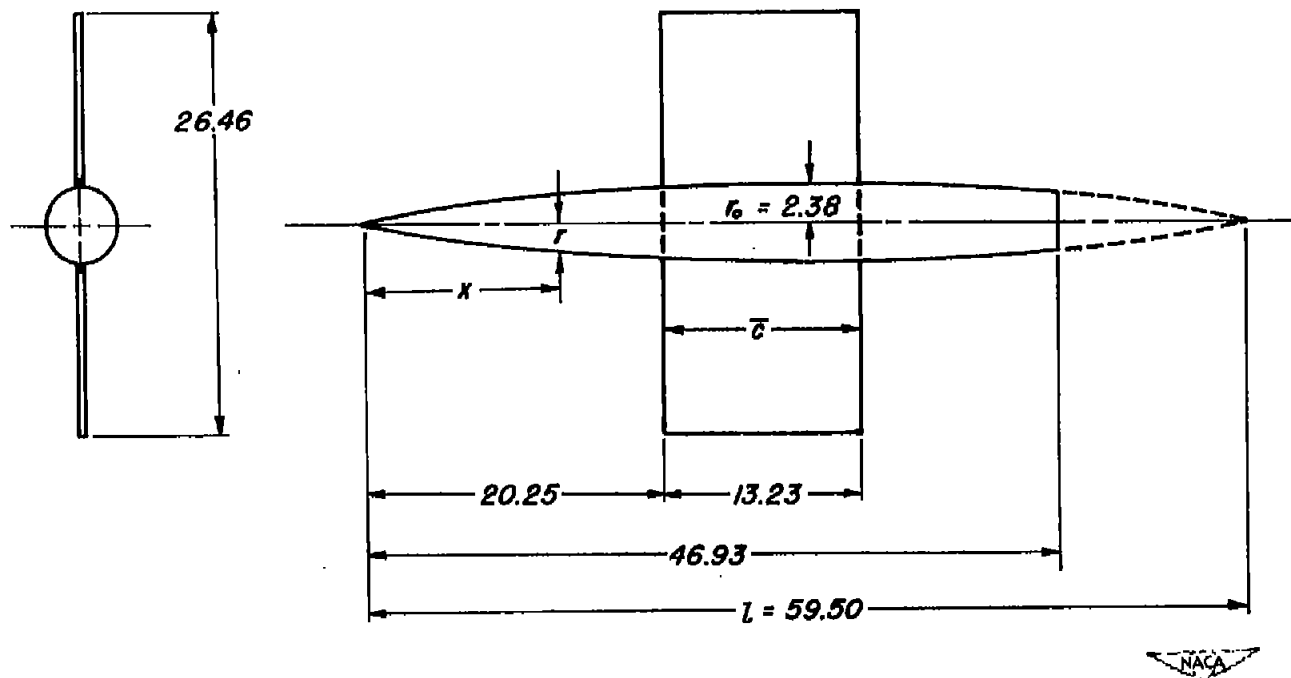| α	c_L	c_D	c_m
0	-.002	0.0104	-.001
-6.45	-.246	.0360	.061
-5.38	-.207	.0283	.051
-4.31	-.167	.0219	.041
-3.23	-.127	.0172	.031
-2.16	-.085	.0138	.021
-1.09	-.046	.0119	.010
-.01	-.002	.0108	-.001
1.08	.044	.0118	-.012
2.16	.087	.0143	-.023
3.22	.127	.0178	-.033
4.30	.168	.0227	-.044
5.38	.208	.0292	-.054
6.46	.248	.0371	-.064

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Equation of fuselage radii:

All dimensions shown in inches.

$$\frac{r}{r_o} = \left[1 - \left(1 - \frac{2x}{l} \right)^2 \right]^{3/4}$$

26.46

$r_o = 2.38$

r

x

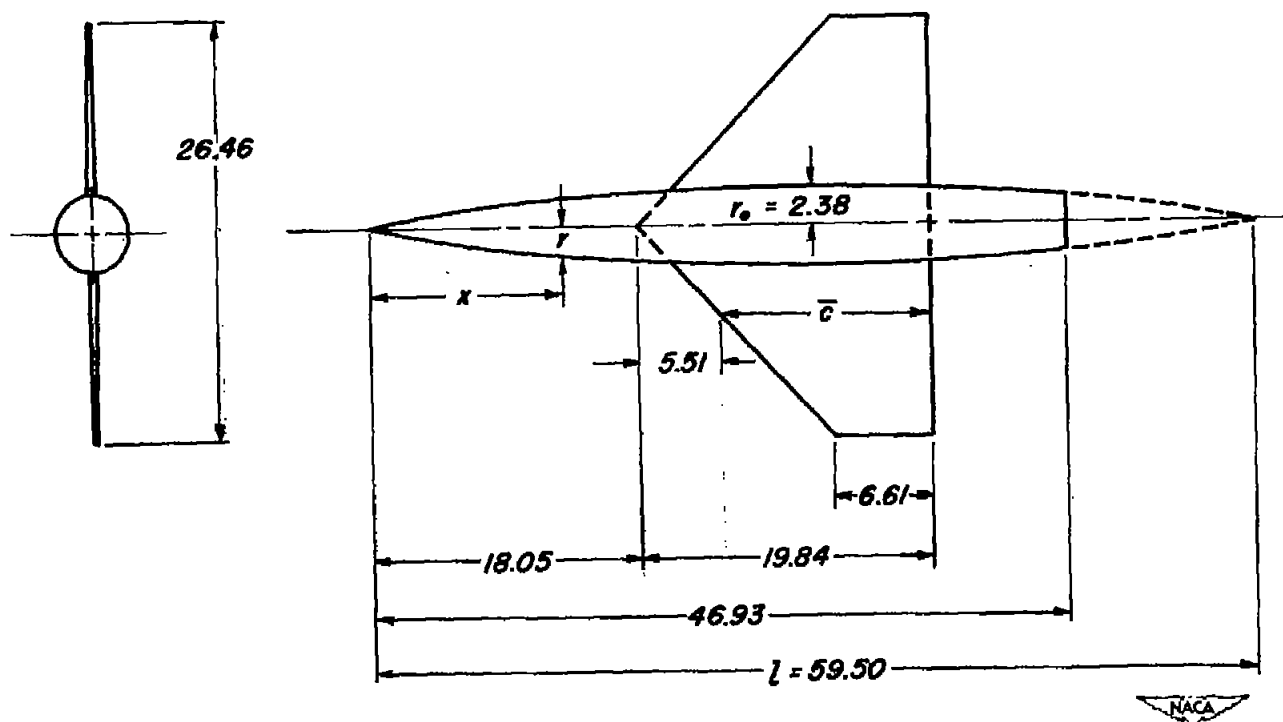$\overline{c}$

20.25

13.23

46.93

$l = 59.50$

(a) Rectangular wing model.

Figure 1.- Plan and front views of the rectangular, swept-back,
and triangular wing models.

Equation of fuselage radii:

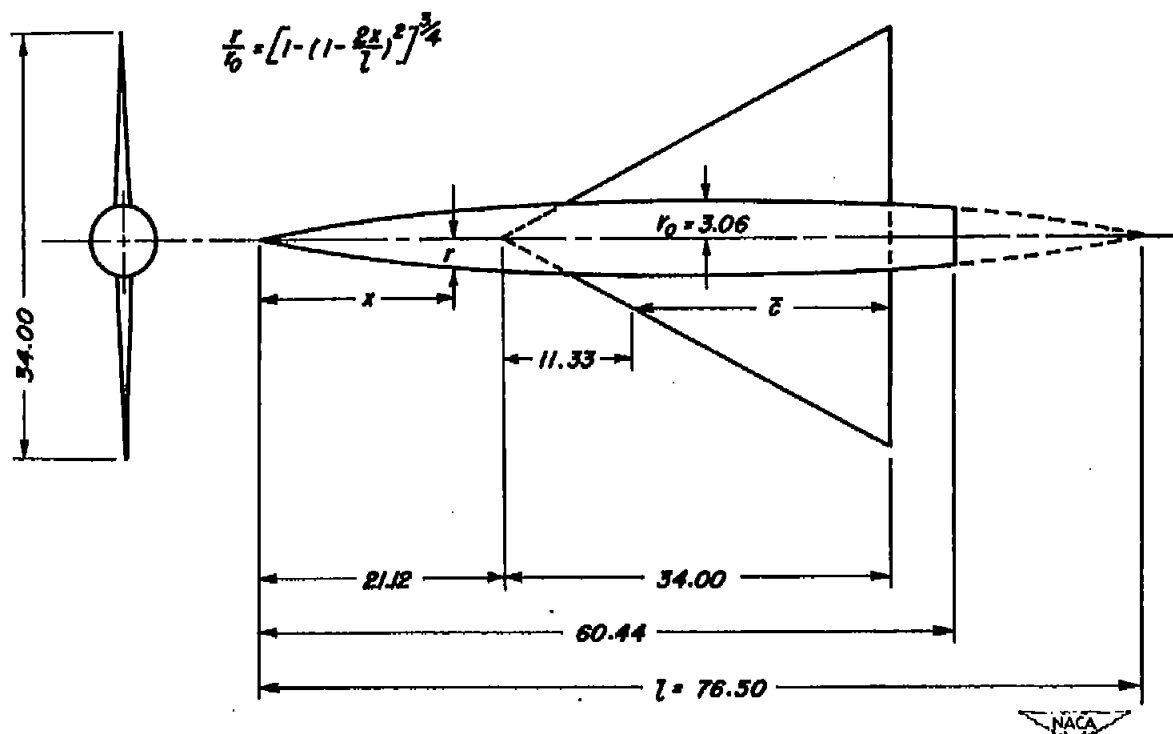$$\frac{r}{r_o} = \left[1 - \left(1 - \frac{2x}{l}\right)^2\right]^{\frac{3}{4}}$$

All dimensions shown in inches.

(b) Swept-back wing model.

Figure 1.- Continued.

Equation of fuselage radii;   All dimensions shown in inches.

$$\frac{r}{r_0}=\left[1-\left(1-\frac{2x}{l}\right)^2\right]^{\frac{3}{4}}$$

$r_0 = 3.06$

34.00

x

r

$\bar{c}$

11.33

21.12 34.00

60.44

$l = 76.50$

(c) Triangular-wing model of reference 1.

Figure 1.- Concluded.
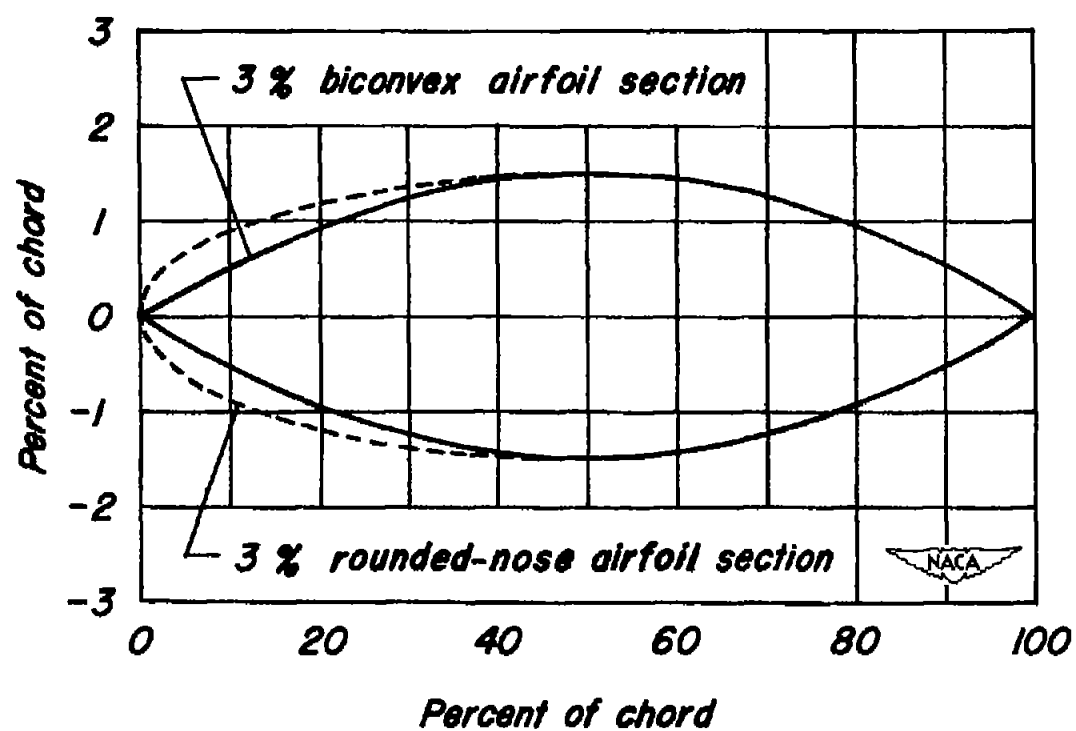
Figure 2.- Comparison of the biconvex airfoil section with the rounded-nose airfoil section.
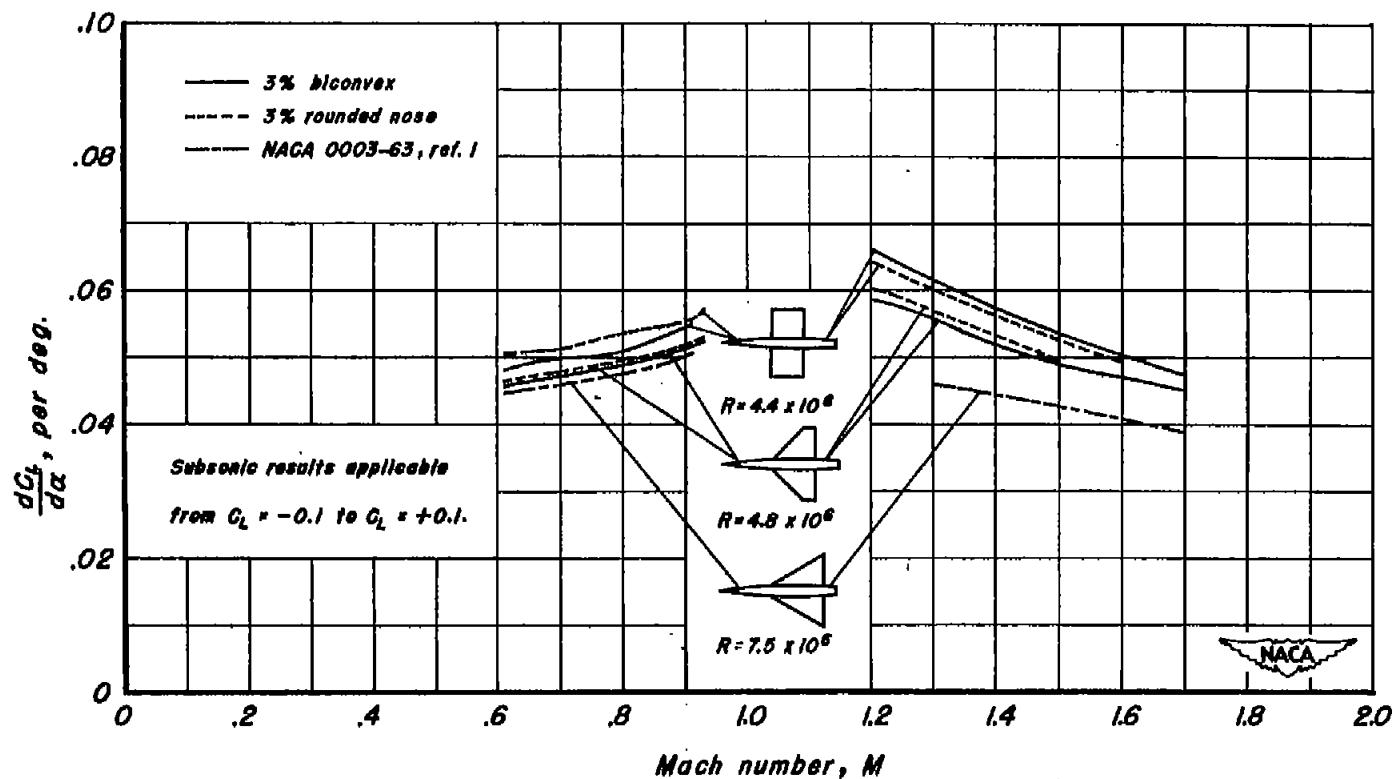
(a) Lift-curve slope.

Figure 3.- Effects of plan form and airfoil thickness distribution on various aerodynamic parameters.
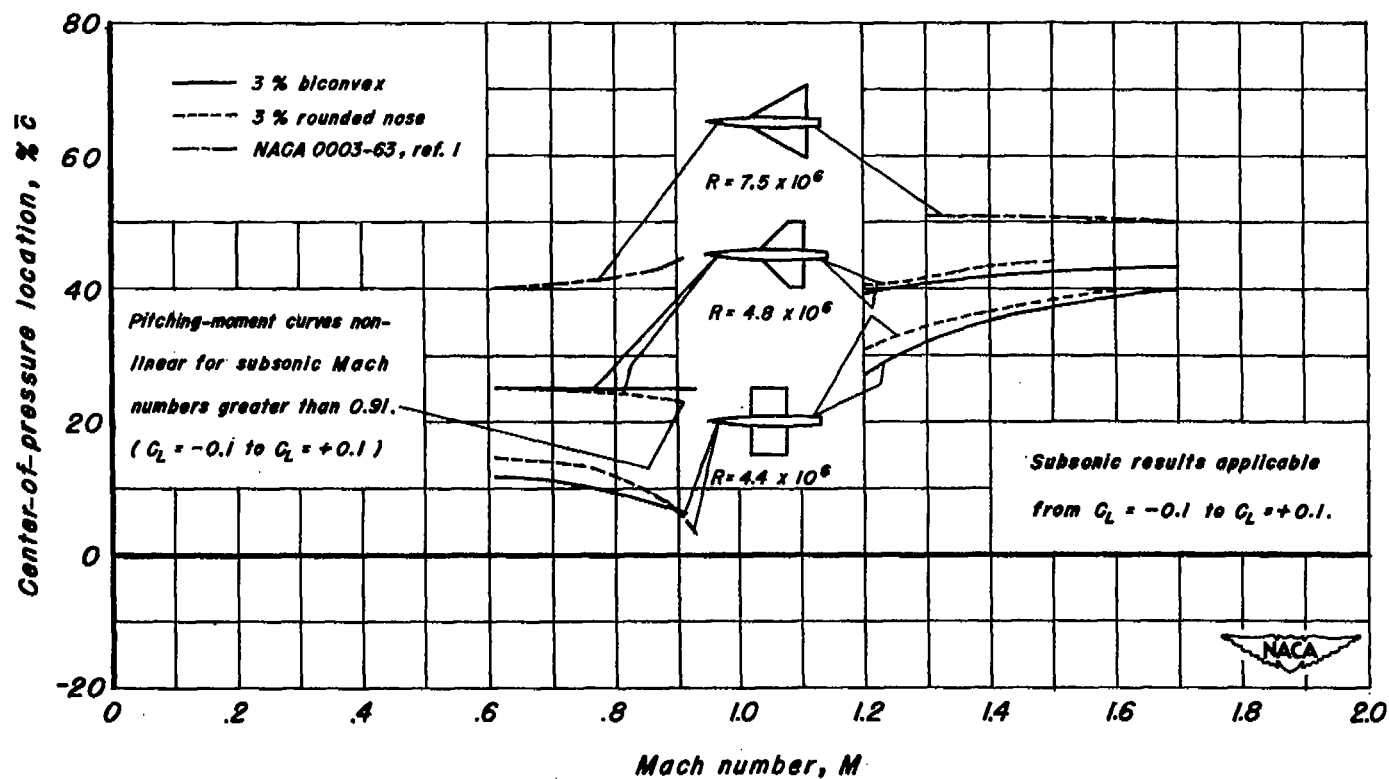
(b) Center-of-pressure location.

Figure 3.- Continued.
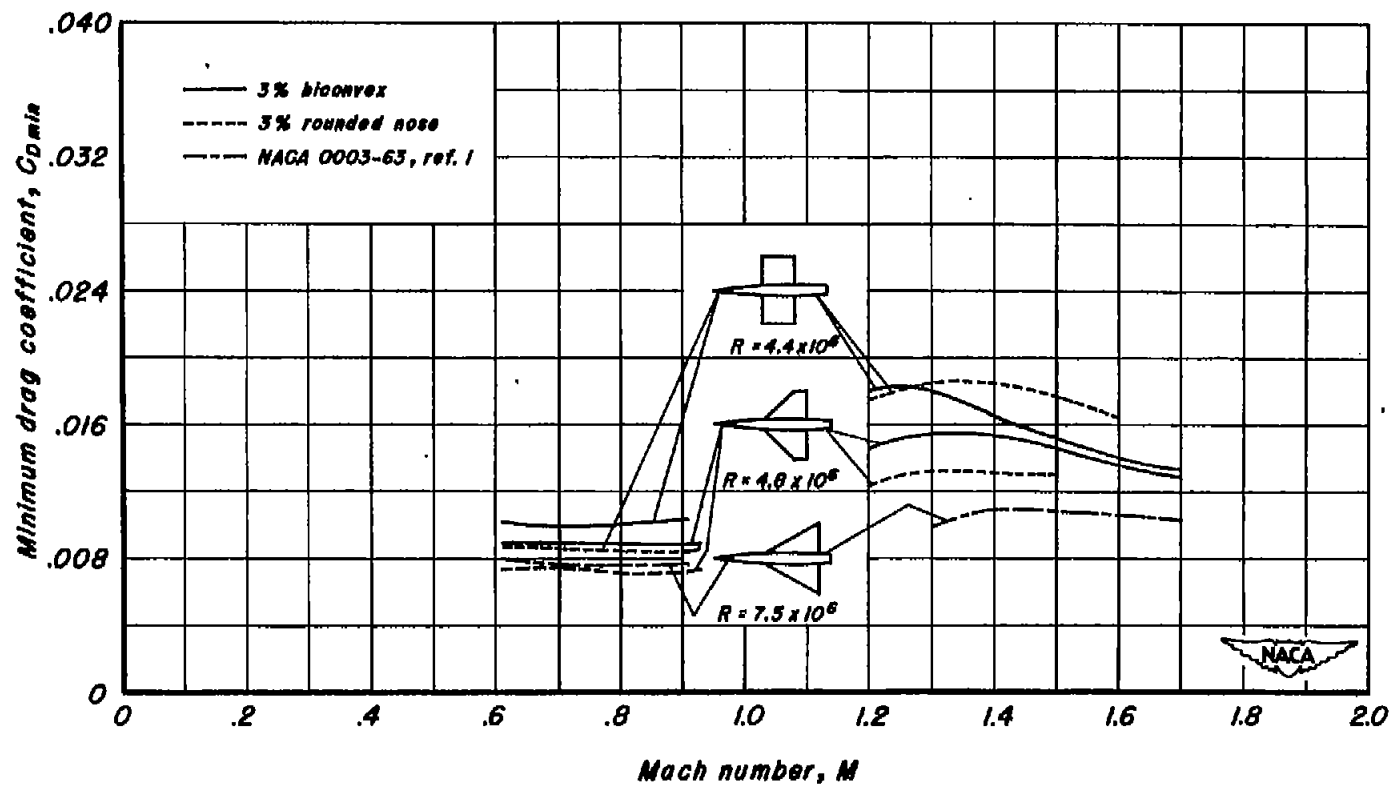
(c) Minimum drag coefficient.

Figure 3.— Continued.
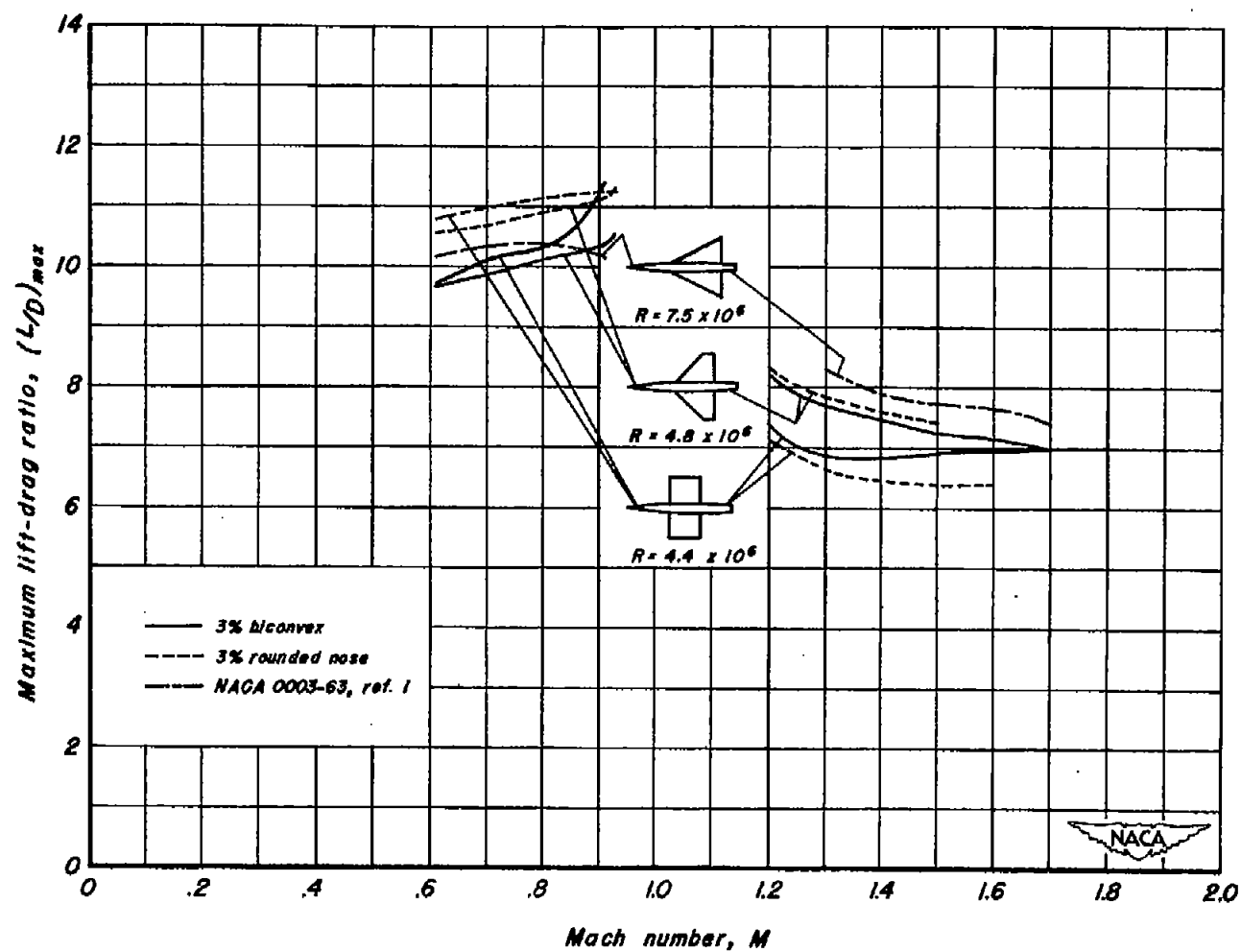
(d) Maximum lift-drag ratio.

Figure 3.- Concluded.
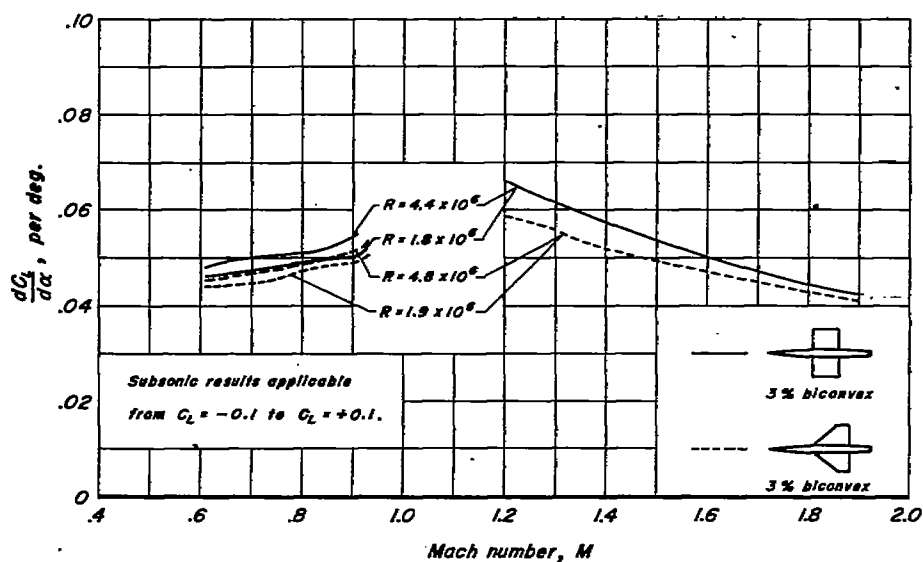
(a) Sharp leading edges.
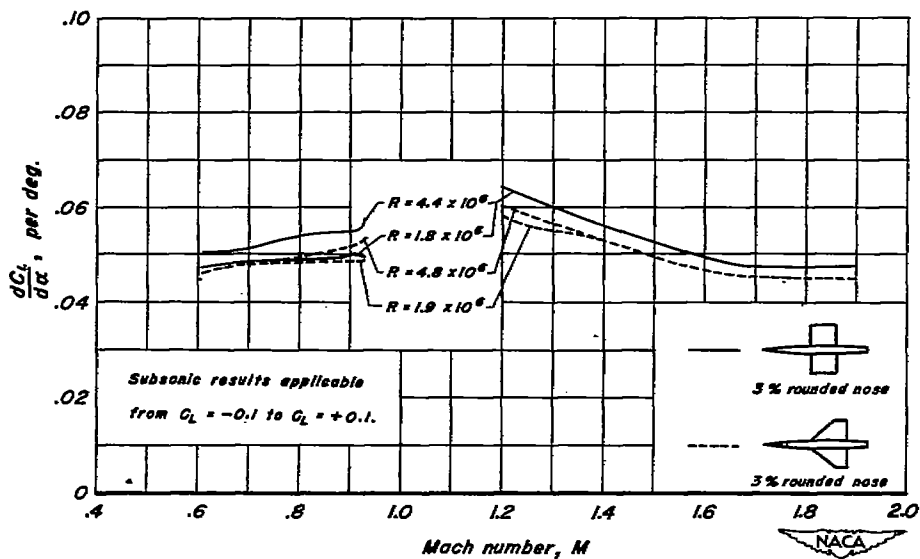
(b) Rounded leading edges.

Figure 4.—Effects of Reynolds number on the lift-curve slopes of wings with sharp and rounded leading edges.
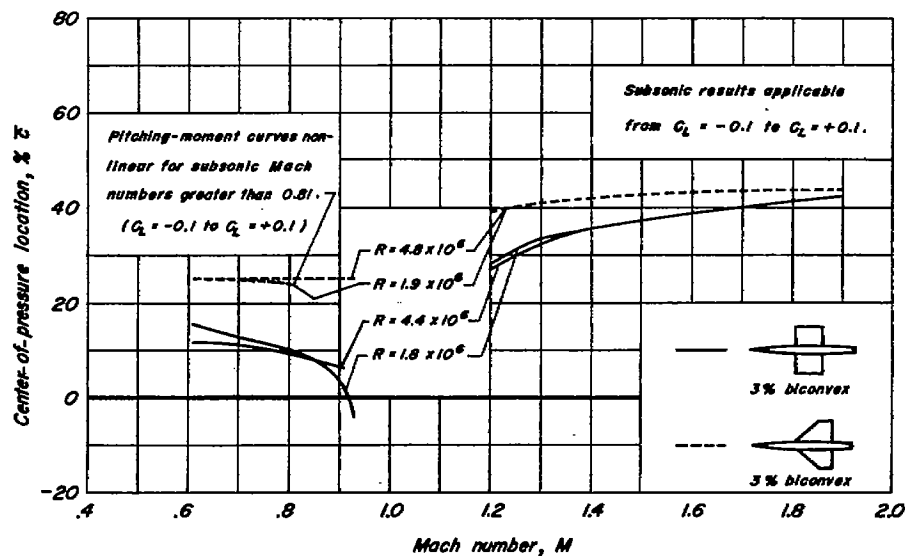
(a) Sharp leading edges.
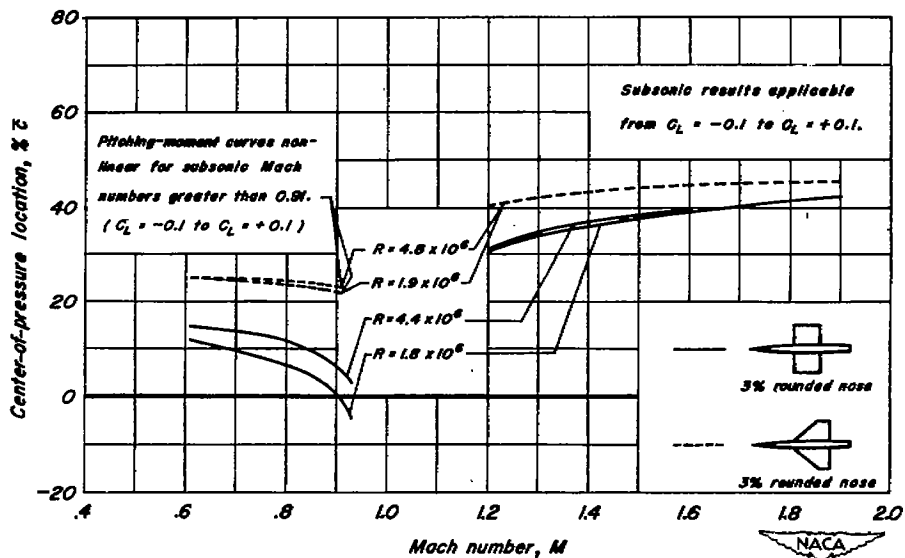
(b) Rounded leading edges.

Figure 5.- Effects of Reynolds number on the center-of-pressure locations of wings with sharp and rounded leading edges.
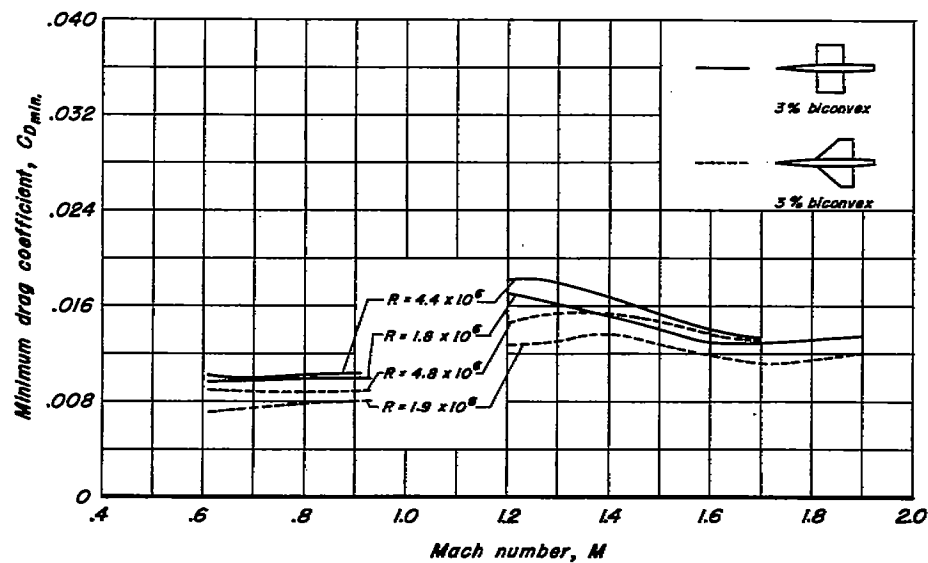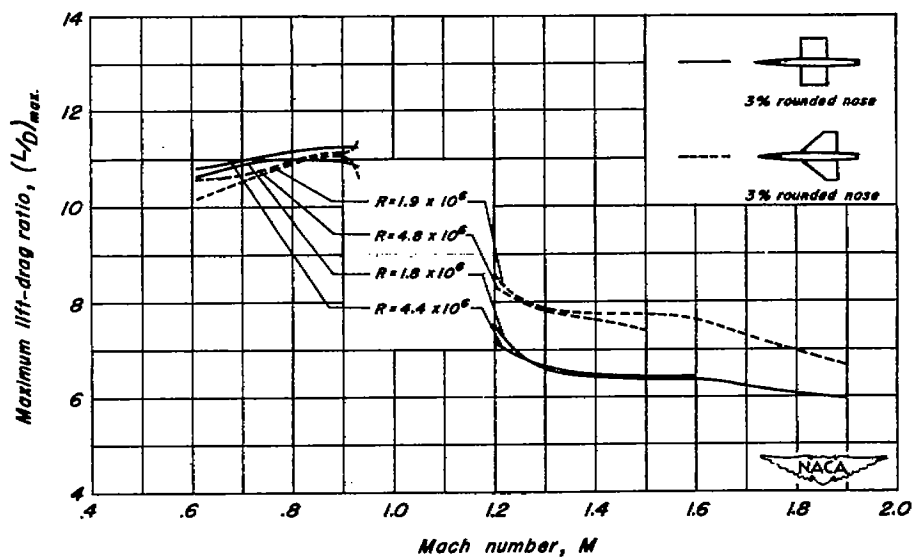
(a) Sharp leading edges.
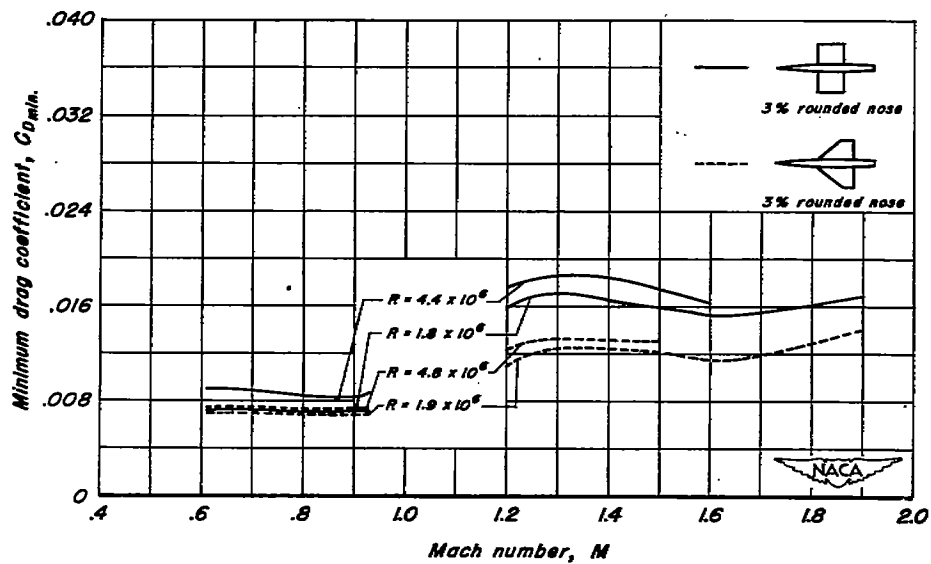
(b) Rounded leading edges.

Figure 6.- Effects of Reynolds number on the minimum drag coefficients of wings with sharp and rounded leading edges.
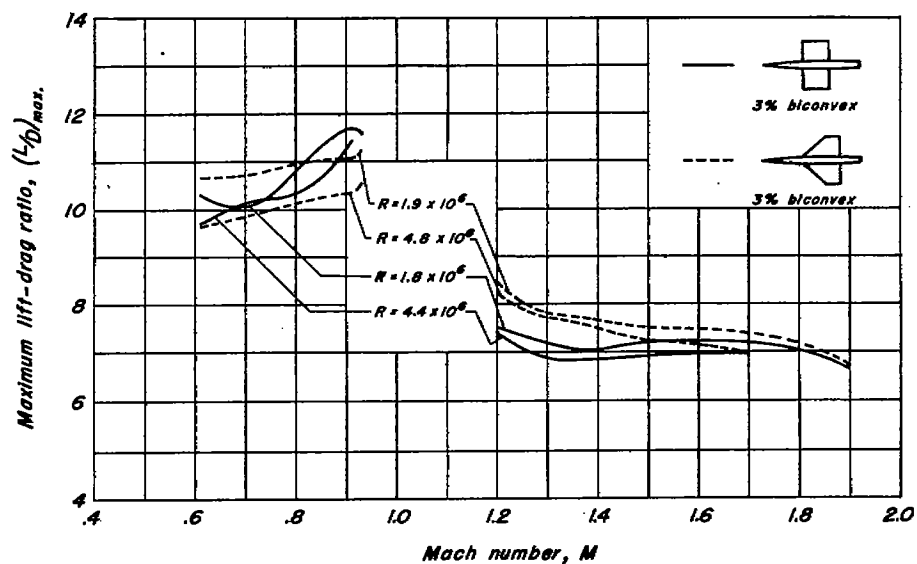
(a) Sharp leading edges.

(b) Rounded leading edges.

Figure 7.-Effects of Reynolds number on the maximum lift-drag ratios of wings
with sharp and rounded leading edges.